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Soaps as Dry-Cleaning Aids*

Stains on Apparel of To-day Unlike Those of Decade Ago—Cost of Volatile Solvents Affected Adherence to Old Standards—Tenacity of Metallic Oxide Stains

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National Association of Dyers & Cleaners

ALMOST from its inception, the dry-cleaning industry has recognized the value of soaps that are readily made into solution in naphtha. The function of such soaps is to remove from garments and other materials stains or soiling substances generally accounted as being soluble only in water and water-soluble detergents.

The soap generally accepted as a standard is a combination of animal or vegetable fat or oil with caustic alkali and a trace of water, and is known in the industry as benzine soap. This soap differs from water-soluble soap only in the lack of complete saponification; hence, it may be described as a super-fatted soap.

The action of super-fatted sodium oleate or stearate soaps in naphtha, it is said, is due to their power to absorb much moisture from the fabric being cleaned, permitting greater penetration of the naphtha and allowing the solvent to "wet" and clean the fabric. Whatever the explanation, interfacial or surface tension relations are involved. Volatile solvents, other than naphtha, incorporated with the benzine-soap base, are quite selective in their action toward stains; that is, one of them may be very active on one type of stain and be of practically no value on the general classification of staining materials or soil met with in dry-cleaning practice.

New Stains To-Day

The general type of stain on wearing apparel to-day is practically foreign to that encountered ten years ago. For example, the culinary art employs a greater variety of condiments, coloring matters, and substitutes for animal fats; milk, because of pasteurization, presents a more difficult problem; and the bottling industry, in one short year, has inveigled us into consuming three cases each of beverage per year instead of one, the beverages containing both coloring and flavoring materials that under certain conditions become indelible in fabric.

The benzine soap once commonly used has become practically obsolete because of the change in stains and soil. One of the very oldest types of this soap contained as high as 50 per cent of methyl alcohol, but this formula was never in general use in this country. The use of alcohol in benzine soap, up to 30 per cent, however, is now becoming popular because of its power to remove from garments many types of soil, the chief of which may be stated to be foodstuffs and beverages.

High-proof alcohol may be used safely as a dry-cleaning solvent, but one that has been slightly reduced in strength with water attacks some dyestuffs in fabric and causes a swelling of the fibers somewhat similar to that caused by water.

Recent research has disclosed that although low-proof alcohol may attack colors when directly applied to dyed silks or rayon, this action is absent when the alcohol is combined in a limited amount, say under 10 per cent, with naphtha in the dry-cleaning process, in hand-brushing applications, or in "spotting" operations.

Cost Affects Use of Solvents

A small amount of alcohol in the soap or naphtha, though inactive on colors, clearly demonstrates its ability to remove stains from garments. The cost of the volatile solvents formerly recognized as of great value when incorporated with benzine soap, had much to do with the general adherence to the old standard type of soap used in dry cleaning. The industry, from necessity, has made further additions of other volatile solvents, regardless of cost; however, many of the solvents have been reduced greatly in price, making their use as cleaning or "spotting" agents more general.

Many skilled workmen who know the fabric and dye-

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stuffs in the garment at hand that is to be treated for certain stains, quickly select from the stock shelf a special "spotting" soap containing one or more special solvents.

The alcoholic benzine-soap in naphtha finds its greatest usefulness in the power-driven machine dry cleaning of garments, whereas the ultra-selective preparations are applied by brush or spatula to the garments between the machine operations. Many volatile solvents may be incorporated with the benzine-soap base, such as ether, chloroform, carbon tetrachloride, amyl acetate, ethyl acetate, carbon disulphide, ethylene dichloride, trichlorethylene, tetrachlorethane, ortho-dichloro-benzene, benzaldehyde, furfurol, pyridine, cresol, phenol (carbolic acid), etc.

Carbon disulphide in soap may be applied safely to all fabrics, but because of its disagreeable odor is rarely desired, although its solvent power is very great on stains that contain sulphur, such as crude oil, old machine oil, road oil; and also on such stains as waterproof inks, tars, and pitch, on which naphtha is inactive. Benzaldehyde and furfurol, in time, it is believed, will find a great field of usefulness in specially prepared benzine soaps.

It was Floyd N. Avery, Chemist Cleaner, of Princeton, Illinois, who made the first observation that lysol diluted with naphtha or soap is of value in stain removal during or prior to the dry-cleaning operation. The solvent power of this product is due to alcohol and cresol combined with its soap base. Many supply houses, because of the unpleasant odor of cresol, have substituted another chemical in their special soaps.

Metallic Oxide Stains

It is interesting and of value to note that although a number of the special volatile solvents, when used alone, attack dyestuffs on garments, yet when added to soap or naphtha in the proportion of 10 per cent or less by weight, free from moisture, they may be applied with safety.

Textile interests are quite familiar with the tenacity of stains produced on fabric by the metallic oxides or sulphides in combination with oil, fat, or soap. This stain is broken up, reducing the surface or interfacial tension, on making an application of benzine soap containing, for example, 10 per cent of ether, after which the fabric may be rinsed free from fatty matter with naphtha. As a further illustration, a white cotton shirt has been observed to contain rust stains from a belt buckle. In laundering, soap combined with the iron oxide, forming a stain that resisted all bleaching processes. An application of soap and ether immediately released the soap, permitting the removal of the iron when properly rinsed. Stains of this character tend to adhere more tenaciously to the fabric on making applications of acid or bleaching agents—until the fatty substance is removed.

An addition of, say, 10 to 12 per cent of volatile solvents to water-washing soap releases metallic-oil stains with even greater rapidity than do dry-cleaning soap preparations.

The real value in the application of benzine soap preparations with subsequent rinsing in naphtha lies in the certainty with which delicate materials may be cleansed without disturbance to the generally accepted type of dressing or finishing materials given fabrics to produce the proper drape, feel and appearance.

ANNUAL KNITTING ARTS SHOW

Reports from the headquarters of the Knitting Arts Exhibition which is to be held in Philadelphia from April 4 to 8, indicate that this exhibit of modern mill equipment will be even larger than it was last year. There are a very few spaces left in Commercial Museum, and these are rapidly being taken by nationally known firms.

Manufacturers come from all over the East to show their machines in operation, realizing that this exhibition sets the pace throughout the trade. The National Association of Hosiery and Underwear Manufacturers has held this display every spring in connection with their annual convention for twenty-three years.

Repeating their success of last year, the association will again hold the annual banquet right in Commercial Museum. This practice was inaugurated last year and was so popular with those members of the association who had displays and consequently did not care to leave them for any length of time, that in all probability this plan will be adhered to for some time to come.

The various convention meetings scheduled for the week will also be held in Commercial Museum so that no exhibitor will have to spend more than a minimum amount of time away from his booth.

For all those who are interested in the latest models of the various machines necessary to the operation of a successful knitting mill, together with the many allied products such as soap, dyes, belting, etc., this exhibition is the place to examine, compare, and purchase in the most convenient manner.

LABOR CONDITIONS IN THE GERMAN CHEMICAL INDUSTRY

Labor conditions in the German chemical industry have been in a state of readjustment ever since the fusion of six of the old I. G. companies under the name of I. G. Farbenindustrie. At a recent meeting in Frankfort of the Union of Employees of the I. G., a member of the I. G. directorate represented the company and spoke of the lately introduced bonus system, of the I. G.'s savings bank, and also mentioned the question of participation in profits by employees. In principle the share of employees in the profits of the company was approved, which under present conditions in Germany was a considerable concession. The speaker for the employees enlarged upon the effects of the fusion upon labor and urged the necessity of better pay if the company desired to encourage savings. (Consul Hamilton C. Claiborne, Frankfort-on-Main.)

Dyes Imported Through New York and Other Ports During January

Compiled by the Chemical Division of the Bureau of Foreign and Domestic Commerce in Collaboration with the Chemical Division of the United States Tariff Commission

KEY TO ABBREVIATIONS OF MANUFACTURERS' NAMES

1—THE SIX LEADING GERMAN COMPANIES

IG—Interessen-Gemeinschaft der Farbenindustrie.
A—Actien-Gesellschaft fur Anilin-Fabrikation, Berlin. Founded 1873.
B—Badische Anilin-und-Soda-Fabrik, Ludwigshafen-on-the-Rhine. Founded 1865.
By—Farbenfabriken, vormals Friedr. Bayer & Co., Leverkusen-on-the-Rhine. Founded 1862
C—Leopold Cassella & Co., Frankfort-on-the-Main. Founded 1870.
K—Kalle & Co., A. G., Biebrich-on-the-Rhine. Founded 1870.
M—Farbwerke, vormals Meister Lucius & Bruning, Hochst-on-the Main. Founded 1862.

2—THE SMALLER GERMAN COMPANIES

BK—Leipziger Anilintabrik Boyer & Kegel, Furstenberg. near Leipzig. Founded 1882.
CG—Chemikaliewerk Griesheim G. m. b. H., Griesheim-on-the-Main. Founded 1882.
CJ—Carl Jager G. m. b. H., Anilinfarbenfabrik, Dusseldorf. Founded 1823
GrE—Chemische Fabrik Griesheim-Electron, Offenbach-on-the-Main. Founded 1842.
L—Farbwerk Mulheim, vormals A. Leonhardt & Co., Mulheim-on-the-Main. Founded 1879
Seig.—G. Seigle Corporation, Stuttgart.
tM—Chemische Fabriken, vormals Weiler ter Meer, Uerdingen-on-the-Rhine. Founded 1877.
WD—Wulfing, Dahl & Co., A. G. Barmen. Founded 1842.

3—SWISS COMPANIES (ALL AT BASEL)

DH—Farbwerke vormals L. Durand, Huguenin & Co. Founded 1871.
G—Anilinfarben-und Extract-Fabriken, vormals Joh. Rud. Geigy. Founded 1764.
I—Gesellschaft fur chemische Industrie. Founded 1885.
S—Chemische Fabrik, vormals Sandoz & Co. Founded 1887

4—DUTCH AND FRENCH COMPANIES

FA—Farbwerk Ammersfoort, Ammersfoort, Netherlands. Founded 1888
NF—Niederlandische Farben-und-Chemikalienfabrik Delft, Delft, Netherlands. Founded 1897.
CN—Compagnie Nationale de Matieres Colorantes et Produits Chimiques. Founded 1917. (Etablissements Kuhlmann merged with this company in 1923.)
P—Societe Anonyme des Matieres Colorantes et Produits Chimiques St. Denis (formerly A. Poirrier). Founded 1830.

5—ENGLISH COMPANIES

Bro—Brotherton & Co., Ltd., City Chambers, Leeds.
BAC—British Alizarine Co., Ltd., Manchester
BD—British Dyestuffs Corporation, Ltd., London.
Cl Co.—The Clayton Aniline Co., Ltd., Clayton, Manchester.
CV—The Colne Vale Dye & Chemical Co., Ltd., Milnsbridge, Huddersfield.
Hol—L. B. Holliday & Co., Ltd., Huddersfield.
Scot—Scottish Dyes, Ltd., Grangemouth.

IMPORTS of coal tar dyes through the port of New York and other ports during the month of January totaled only 196,620 pounds, with an invoice value of $186,387, a decrease of approximately 40 per cent from the December imports. Of these 127,074 pounds were entered through New York, with an invoice value of $173,832, and 9,546 pounds through Boston, with an invoice value of $12,555.

Per Cent of Dyes by Country of Shipment

	Per Cent
Germany	37
Switzerland	34
Belgium	11
England	7
France	7
Italy	3
Canada	1

Five Leading Dyes, by Quantity, Imported During January, 1927

	Pounds
Rhodamine B extra (single strength)	8,300
Anthra Yellow GC (single strength)	6,149
Erioglaucine	6,063
Thionol Green B	5,779
Gallamine Blue Extra Paste	5,004

Dyes and Intermediates Remaining in Bonded Customs Warehouse

	Dyes and Colors (pounds)	Intermediates (pounds)
July 31, 1926	512,186	781,796
August 31, 1926	557,852	690,031
September 30, 1926	395,535	590,520
October 31, 1926	281,320	557,257
November 30, 1926	303,321	539,561

The dyes in this report are grouped by both Colour Index and Schultz numbers, and, in the case of those which could not be identified by either number, the classification according to the ordinary method of application was adopted. As the pastes and powders of the vat dyes vary widely in strength and quantity, each vat dye has been reduced—in nearly every case—to a single-strength basis.

DYES OF COAL-TAR ORIGIN

Colour Index No.	Schultz No.	Name of Dye and Mfr.	Quantity (pounds)
27	38	Crystal Orange—(IG)	50
32	182	Brilliant Sulphon Red B, 5B—(S)	2,300
172	159	Acid Alizarine Black R—(IG)	500
196	175	Acid Ponceau E—(G)	220
225	194	Thiazine Red RXX—(IG)	100
252	227	Cotton Scarlet Extra—(IG)	100
292	260	Eriochrome Verdone S—(G)	551
316	273	Diazamine Blue BR Conc.—(S)	961
317	274	Diaminogene Extra Powder—(C)	440
324	—	Developed Brilliant Orange GR—(By)	357
349	—	Chlorantine Fast Yellow 4GL—(I)	848
430	—	Polar Red G Conc.—(G)	2,205
451	366	Deltapurpurine 5B—(Q)	295
487	400	Acid Anthracene Red 3B—(IG)	200
597	—	Benzo Chrome Brown R—(IG)	75
629	207	Diphenyl Fast Brown GF—(G)	551
639	22	Xylene Light Yellow 2G—(S)	1,000
649	26	Triazogene Orange R Powder—(IG)	100
652	29	Eriochrome Red B—(G)	
		Omega Chrome Red B Conc.—(S)	720
663	500	Setocyanine—(G)	220
667	503	Benzyl Green B—(I)	
		Neptune Green SGX Powder—(B)	936
671	506	Erioglaucine AP—(G)	
		Erioglaucine EP—(G)	6,063
672	507	Xylene Blue VS Conc.—(S)	1,000
673	508	Xylene Blue AS Conc.—(S)	200
681	516	Crystal Violet Extra Powder—(IG)	650
682	518	Ethyl Violet—(IG)	1,000
691	523	Fast Green Extra Bluish Conc.—(IG)	2,370
712	543	Patent Blue V—(IG)	500
714	545	Brilliant Acid Blue A—(IG)	
		Kiton Blue A—(I)	893
715	546	Blue FF Powder—(C)	
		Cyanol FF Powder—(C)	330
720	551	Eriochrome Azurol BC—(G)	2,205
723	554	Chrome Azurol S Conc.—(G)	551
727	557	Chrome Violet CG—(DH)	110
729	559	Basic Pure Blue BO Powder—(B)	
		Victoria Pure Blue BO Powder—(IG)	1,201
735	564	Erio Green B Supra—(G)	1,102
749	573	Rhodamine B Conc. (s. s.)—(G)	
		Rhodamine B Extra (s. s.)—(IG)	
		Rhodamine B Extra (s. s.)—(Q)	8,300
788	603	Brilliant Acridine Orange A—(DH)	
		Euchrysine 3RX Powder—(B)	1,322
793	606	Phosphine O—(IG)	300
795	607	Runic AL Conc.—(IG)	300
797	608	Patent Phosphine GRNTN—(IG)	500
828	672	Azo Carmine GX—(IG)	500
829	673	Rosinduline 2B Bluish—(K)	128
833	—	Acid Blue BL Powder—(By)	
		Acid Fast Blue GL Powder—(By)	660
865	700	Nigrosine T—(IG)	
		Silver Gray P—(A)	250
873	681	Direct Gray R Paste—(G)	2,546
875	923	Fur Black DF—(IG)	
		Fur Blue Black A—(IG)	
		Fur Brown P—(IG)	
		Fur Gray G—(IG)	
		Fuscamine G—(IG)	
		Nako 3GA—(IG)	1,250
879	—	Chromazurine E—(DH)	220
884	627	Chromacetine Blue S Extra—(DH)	441
892	635	Modern Violet—(DH)	1,101
894	637	Gallamine Blue Extra Paste—(G)	5,004
927	663	New Methylene Blue N—(IG)	
		New Methylene Blue NS Conc.—(S)	2,250
969	748	Hydron Blue R Paste—(IG)	
		Hydron Blue R Powder (s. s.)—(IG)	1,167
1019	774	Alizarine Black S Paste—(IG)	476
1033	779	Alizarine Orange A Paste—(IG)	414
1034	780	Alizarine Red S Powder—(Q)	551
1060	801	Anthracene Blue SWGG Extra—(B)	495
1073	852	Alizarine Direct Violet ER Powder—(IG)	100
1075	856	Alizarine Blue AS Powder—(By)	1,434
1076	859	Alizarine Light Blue R Conc.—(S)	500
1077	860	Alizarine Direct Blue BGAOO—(IG)	1,800
1080	853	Anthraquinone Violet Powder—(B)	440
1084	854	Alizarine Viridine FF Paste—(IG)	
		Alizarine Viridine FF Powder (s. s.)—(IG)	
		Alizarine Viridine FF Paste—(DH)	3,603
1085	862	Chrome Blue Black B—(I)	1,102
1088	855	Alizarine Sky Blue B—(IG)	
		Alizarine Sky Blue B—(By)	838
1091	—	Anthra Rubine B Powder—(K)	440
1095	759	Anthra Yellow GC Paste—(B)	
		Anthra Yellow GC Paste Fine—(IG)	
		Anthra Yellow GC Powder (s. s.)—(B)	6,149
1097	761	Vat Orange RRT Paste Fine—(IG)	2,408
1104	767	Vat Violet RR Extra Double Paste—(B)	1,320
1106	838	Vat Blue RSP Triple Powder (s .s.)—(IG)	1,500
1109	840	Vat Blue 3G Double Paste (s. s.)—(B)	990
1110	841	Vat Blue GGSZ Double Paste (s. s.)—(IG)	1,000
1113	842	Indanthrene Blue GCD Dbl. Pst. (s. s.)—(B)	1,760
1114	—	Vat Blue BCD Paste Fine—(B)	
		Vat Blue BCS Powder (s. s.)—(B)	3,030
1116	847	Vat Green BB Powder (s. s.)—(IG)	800
1118	849	Sandothrene Yellow NG Dbl. Pst. (s. s.)—(S)	100
1128	818	Algol Pink R Powder (s. s.)—(By)	800
1133	819	Algol Red R Extra Powder (s. s.)—(IG)	1,600
1138	810	Helindone Yellow 3GN Powder (s. s.)—(IG)	250
1149	873	Vat Brown IGR Paste—(M)	55
1150	833	Grelanone Olive B Paste—(GrE)	
		Vat Olive R Paste—(IG)	3,032
1151	—	Vat Brown R Paste—(By)	397
1152	—	Vat Brown G Powder (s. s.)—(By)	3,264
1155	825	Algol Red B Paste—(IG)	397
1162	831	Vat Red RK Paste—(B)	
		Vat Red RK Powder (s. s.)—(IG)	2,921
1172	794	Cibanone Black B Paste New—(I)	551
1175	—	Cibanone Olive B Powder (s. s.)—(I)	1,100
1184	881	Brilliant Indigo 4B Powder (s. s.)—(IG)	2,500
1186	883	Indigo MLB/6B Powder (s. s.)—(IG)	2,500
1207	912	Anthra Red B Paste Fine—(IG)	1,003
1212	918	Ciba Red 3B Paste—(I)	
		Thioindigo Red 3B Powder (s. s.)—(K)	3,419
1217	913	Helindone Orange R Paste—(IG)	500
1218	915	Vat Scarlet R Paste—(IG)	200
1226	906	Ciba Red G Powder (s. s.)—(I)	4,410
1228	907	Anthra Scarlet 2G Paste—(B)	
		Ciba Scarlet G Extra Powder (s. s.)—(I)	
		Helindone Fast Scarlet C Paste—(IG)	4,287

UNIDENTIFIED DYES

Acid Dyes

Name of Dye and Manufacturer	Quantity (pounds)
Acid Brown RN—(G)	220
Acid Pure Blue R Supra—(G)	1,102
Azo Fast Blue BD Conc.—(IG)	150
Brilliant Milling Blue B—(C)	1,695
Brilliant Wool Blue FFR Extra—(IG)	
Brilliant Wool Blue FFR Extra—(By)	1,596
Cloth Fast Orange G—(I)	220
Cloth Fast Yellow G—(I)	550
Erio Fast Yellow AE—(G)	110
Guinea Fast Red 2BL—(A)	500
Indocyanine B Powder—(A)	3,305
Lanasol Blue R—(I)	110
Milling Red 4BA—(IG)	100
Neolan Green LBN Conc.—(I)	2,204
Onis 3B—(IG)	500
Pilatus Fast Orange R—(IG)	25
Pilatus Fast Red R—(IG)	25
Polar Orange R Conc.—(G)	2,205
Sulphon Yellow R—(IG)	500
Supramine Brown G—(IG)	300
Wool Fast Blue BR—(I)	110
Wool Fast Brown 3R Paste—(By)	100
Wool Fast Yellow 5G—(By)	224
Xylene Brilliant Blue FFRX Conc.—(S)	300
Xylene Fast Blue FF Conc.—(S)	1,000

Vat Dyes

Anthra Orange RH Paste Fine—(IG)	500
Anthra Scarlet B Paste—(IG)	
Anthra Scarlet B Powder (s. s.)—(IG)	1,100
Brilliant Indigo Blue 3BW Conc.—(IG)	20
Ciba Brown G Paste—(I)	220
Eridan Brilliant Scarlet B Paste—(IG)	500
Grelanone Red 2B Paste—(IG)	220
Helindone Printing Black RD Paste—(IG)	3,500
Hydron Brown G Paste—(IG)	1,000
Indigosol AZG—(IG)	100
Indigosol HB—(DH)	22
Indigosol OR—(DH)	110
Indigosol Black TB—(DH)	110
Indigosol Red HR—(IG)	100
Thioindone Scarlet BB Paste—(K)	55
Vat Bluish Green B Double Paste Fine (s. s.)—(IG)	1,014
Vat Brilliant Blue R—(B)	110
Vat Printing Brown R Paste—(IG)	2,130
Vat Red GG Paste—(B)	
Vat Red GG Powder—(IG)	776
Vat Red BK Paste Fine—(IG)	1,094
Vat Red Brown RP Paste—(B)	805
Vat (Hydron) Scarlet 3B Powder (s. s.)—(C)	1,284
Vat Yellow GPO Powder—(IG)	1,000

Mordant and Chrome Dyes

Alizarine Blue 2B Powder—(Q)	220
Chromazurine DN—(DH)	220
Chrome Printing Red B—(DH)	441
Chrome Printing Red Y—(DH)	441
Chromocitronine 3R—(DH)	220
Chromogene Red BD—(IG)	200
Eriochromal Brown G Powder—(G)	110
Eriochrome Geranol R Conc.—(G)	551
Eriochrome Red G—(G)	1,102
Eriochrome Violet 3B Supra—(G)	110
Metachrome Blue Black 2BX Powder—(A)	551
Metachrome Violet 2R—(IG)	100
Metachrome Red G—(IG)	500

Direct Dyes

Benzo Chrome Brown 5G—(IG)	50
Benzo Fast Black L Powder—(By)	110
Benzo Fast Blue 8GL—(IG)	500
Benzo Fast Brown 3GL—(IG)	500
Benzo Fast Brown RL—(IG)	1,000
Benzo Fast Gray BL—(IG)	900
Brilliant Benzo Green B—(By)	330
Brilliant Pure Yellow 6G Extra—(By)	551
Brilliant Sky Blue 8G Extra—(By)	613
Brilliant Sky Blue G—(IG)	100
Chicago Red III—(G)	2,205
Chloramine Fast Orange G Conc.—(S)	500
Chlorantine Fast Blue 2GL—(I)	441
Chlorantine Fast Brown 3RL—(I)	1,763
Chlorantine Fast Brown BRL—(I)	1,102
Chlorantine Fast Green B—(I)	1,653
Chlorantine Fast Violet 5BL—(I)	55
Chlorantine Fast Yellow RL—(I)	551
Chlorazol Fast Brown RK—(BD)	1,500
Chlorazol Fast Orange AG—(BD)	500
Columbia Catechine G—(IG)	500
Developed Blue—(Q)	991
Diamine Brilliant Scarlet S—(IG)	500
Diamine Catechine B—(IG)	200
Diamine Fast Brown R—(IG)	500
Diamine Fast Orange ER—(IG)	400
Diaminogene GG—(C)	1,542
Diazanil Scarlet 3BA Conc.—(IG)	75
Diazo Brilliant Green 3G—(By)	2,093
Diazo Brown 3G—(By)	496
Diazo Brown 6G—(By)	110
Diazo Fast Black VB—(IG)	800
Diazo Fast Violet BL—(By)	331
Diazo Sky Blue 3GL—(By)	1,151
Diphenyl Dark Green BC—(G)	441
Diphenyl Fast Bordeaux BC—(G)	110
Direct Safranine RW—(I)	220
Formal Fast Black G Conc.—(G)	110
Naphthogene Blue B—(A)	59
Rapid Fast Orange RG Paste—(IG)	300
Sky Blue N—(IG)	200
Triazol Light Orange 2RL—(GrE)	110

Dyes for Artificial Silk

Cellit Fast Red B—(IG)	50
Duranol Black Paste—(BD)	1,051
Duranol Blue G Paste—(BD)	386
Duranol Orange G Paste—(BD)	330
Red Violet Extra Paste—(IG)	100

Basic Dyes

Brilliant Acridine Orange 3R—(DH)	220
Brilliant Acridine Orange 5R—(DH)	220

Sulphur Dyes

Immedial Brown W Conc.—(IG)	500
Indo Carbon CL—(IG)	1,000
Indo Carbon SN—(IG)	500
Thionol Green B—(BD)	5,779

Color-Lake Dyes

Hansa Yellow GSA—(IG)	1,000
Helio Fast Blue BL Conc. Powder—(By)	55

LIST OF APPRAISEMENTS OF COAL-TAR PRODUCTS WITHIN PARAGRAPHS 27 AND 28 OF THE TARIFF ACT OF 1922

The following supplemental list contains the month of entry, the name of the product within paragraphs 27 and 28, together with the designations as "C" (for competitive) and "NC" (for non-competitive), which indicates the appraisement basis for the assessment of the ad valorem duty in paragraphs 27 and 28 of the Tariff Act of 1922.

The ad valorem rate for competitive dyes is based on the American selling price, as defined in Subdivision (f) of Section 402 of Title IV; the ad valorem rate for non-competitive dyes is based on the United States value, as defined in Subdivision (d) of Section 402 of Title IV of the Tariff Act of 1922.

This list contains the appraisements received since the publication of the November list for the Port of New York, beginning with January, 1926.

JANUARY

Anthraquinone Violet	NC
Vat Bordeaux B Extra Powder	NC
Vat Orange RF Powder	C
Vat Pink FB Powder	NC
Vat Red Violet RH Powder	NC
Sulpho Rhodamine G Powder	NC

MARCH

Vat Pink B Powder	NC

APRIL

Acid Milling Black B652 50%	C
Acid Milling Red R Conc. 666 65%	C
Anthra Scarlet 2G Paste 17%	NC
Diphenyl Chrysoine RRC 121 90%	NC
Diphenyl Fast Brown GF 365 80%	NC
Diphenyl Fast Gray BC 254 60%	NC
Erio Green B Supra 657 80%	C
Eriochrome Blue S 955 60%	NC
Eriochrome Cyanine RC 935 80%	NC
Hydron Scarlet 3B Powder	NC
Mimoza Z Conc. 331 85%	C
Novazol Blue B 966 65%	NC
Novazol Violet B 769 85%	NC
Seto Glaucine 753 55%	NC
Vat Pink B Powder	NC

MAY

Alizarine Astrol B Powder (soluble in oil)	NC
Chromoxane Pure Blue B 60%	NC
Chrome-Azurol S Conc. 1004 80%	NC
Crystal Violet C Conc. 451 90%	C
Erio Cyanine AC 503 75%	C
Erio Glaucine EP 548 75%	NC
Eriochrome Yellow G Paste 946 20%	C
Guinea Fast Red 2R 60%	C
Helio Purpurine 7BL 50%	NC
Novazol Violet B 769 85%	NC
Polar Orange R Conc. 599 90%	NC
Polar Red RS Conc. 606 75%	NC
Sorrel Red X 100%	C
Tero Yellow FR 100%	NC
Thiazine Red RXX 100%	C
Vat Scarlet G Extra	NC
Vat Yellow 3RT Powder 10%	NC
Zambesi Black F 55%	C

JUNE

Acid Anthracene Brown PG	NC
Alizarine Blue AS Powder	NC
Alizarine Red SX Paste 20%	C
Alizarine Supra Blue A 60%	NC
Anthra Orange RH Paste Fine 10%	C
Anthra Red B Paste 20%	NC
Azo Carmine GX 97%	NC
Brilliant Rhoduline Blue R 40%	NC
Congo Orange R 95%	NC
Danubia Blue BX 25%	NC
Developed Sky Blue 3GL	NC
Diamine Orange B	NC
Diamine Yellow N	NC
Eridan Brilliant Scarlet B Paste 18%	NC
Helindone Printing Black RD Paste 20%	NC
Lake Fast Yellow G Powder	NC
Metachrome Blue Black 2BX Powder	NC
Rhodamine B Extra 100%	C
Sandothene Blue NGCD Paste	C
Vat Golden Orange G Double Paste Fine 20%	C
Wood Blue N Extra Powder	NC
Wood Fast Orange G Powder	NC

JULY

Acid Rhodamine BG Powder	NC
Alizarine Blue SKY Powder	NC
Alizarine Direct Blue RXO 100%	NC
Alizarine Green S Paste 25%	NC
Anthra Yellow GC Paste Fine 10%	NC
Anthracene Brown PG	NC
Brilliant Dianil Blue 6G 25%	NC
Brilliant Milling Blue B Powder	NC
Developed Brilliant Green 3G	NC
Diamine Fast Orange ER 60%	C
Indocyanine B Powder	NC
Rosinduline 2B Bluish	NC

AUGUST

Acid Milling Red R Conc. 666 65%	C
Alizarine Blue JR	NC
Alizarine Red W Powder 100%	C
Alizarine Sky Blue B Powder	NC
Aurine 100%	NC
Basic Pink G Powder 100%	NC
Brilliant Benzo Violet B	C
Brilliant Milling Blue B	NC
Brilliant Sky Blue 8G Extra	NC
Cyanole Extra	NC
Developed Brilliant Green 3G 100%	NC
Diphenyl Catechine G Supra 80%	NC
Eriochrome Geranol R Conc. 991 65%	NC
Eriochrome Red G 978 45%	NC
Metachrome Blue Black 2BX 100%	NC
Novazol Blue B 966 65%	NC
Rhodamine B Conc	C
Setacyl Direct Blue G Powder 781 10%	NC
Wool Black GRF 67%	C
Wool Blue RR Extra	NC

SEPTEMBER

Alizarine Red S Powder	C
Brilliant Milling Blue B	NC
Chloramine Red 3B	C
Cyanole Extra	NC
Developed Sky Blue 3GL	NC
Diaminogene Blue NA 200%	C
Direct Red 12B Powder	C
Fast Acid Yellow 3G	C
Indol	NC
Trisulfon Brown B Conc	C

(Continued on page 140)

Proceedings of the American Association of Textile Chemists and Colorists

The American Association of Textile Chemists and Colorists

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JANUARY MEETING OF THE NEW YORK SECTION

The January meeting of the New York Section of the American Association of Textile Chemists and Colorists convened Friday evening, January 28, 1927, at the Machinery Club, New York City, Chairman Herbert Grandage presiding.

When the routine business of the Section had been transacted the Chairman introduced the first speaker. . . .

Chairman Grandage—Our first paper to-night will be presented by Mr. Marsson. Mr. Marsson requires no introduction to the members of the New York Section. I am sure the paper will be well worth while. He has chosen for his subject, "A Short Visit to the Naphthol Dyehouse and the Problems of the Dyer."

Mr. Marsson!

. . . R. W. Marsson then presented his prepared paper:

A Short Visit to the Naphthol Dyehouse, and the Problems of the Naphthol Dyer

By R. W. MARSSON
General Dyestuff Corporation

It has been requested by the trade that I offer another talk on Naphthols. I'm very happy to do this, the more so as this group of insoluble azo colors is finding an increased market in its adoption on various textiles. There have been three articles on the subject during the last year in the AMERICAN DYESTUFF REPORTER. Only one of them touched the practical application and this, I believe, is the point that is most interesting and where close co-operation is most essential.

Like every new group of fast colors a great deal of pioneer work has to be accomplished in firmly entrenching them on a practical scale. There were much prejudice and many obstacles before reliable results were obtained with vat colors, for instance. The same has been the case with the naphthol combinations which are, as we know, insoluble azo colors produced directly upon the fiber by the means of diazotized aromatic amine with naphthols. Although they are partly pre-war products, only the last five years have undisputedly established their practical value. They possess an excellent fastness to washing and to chlorine, to alkalies and acids, and withstand both mercerizing and cross-dyeing. Fastness to light of the most important combinations is "good to excellent." AS-SW and AS-TR, developed with the proper bases, are particularly fast to boiling with caustic soda, even to kier boiling under low pressure. Yellow dyeings produced with AS-G and Scarlet or Yellow Base are absolutely fast to kier boiling. In addition to the fastness and brilliancy of these colors they offer the following special advantages: 1. Simple mechanical arrangements; 2. Small oil consumption; 3. Little waste in winding; 4. Saving of steam and labor; 5. Large and rapid production; 6. Dye cotton in every state of manufacture.

We bring, as you know, most of the bases in already diazotized salt form into the market and have recently

increased these developing agents by Fast Black Salt B and Fast Red Salt TR. In order to facilitate the application of these salts for pressure machine dyeing, especially where naphthols of non-substantive character are used, we have brought into the market the Fast Red Salt GLA, Fast Red Salt BA and Fast Blue Salt BA. They are dissolved like the others, in plain water and then neutralized in the dyehouse with sodium acetate instead of aluminum sulphate, which latter chemical in conjunction with the oil of the naphthol bath forms the undesirable aluminum soap.

Since I am working under the naphthol flag, I have had occasion to sound the market and demonstrate in various countries on both sides of the water. The simplicity of their application is typically demonstrated, for instance, by their adoption in extremely primitive dyehouses. There were cases where I had nothing but an empty dyestuff keg at my disposal for impregnation, as well as developing action and making up a stock liquor in the same and feeding afterwards. The output was quite decent in some instances.

The real possibilities, however, of what naphthols can do and *will* do developed here in this country where those two big items—production and cost—are constantly facing the chemist and the dyer. It was here that I made my first big dive into the problem of application on a large scale, and I welcome this opportunity to make a little statement of gratitude to the mill official, chemist and colorist (even if taken into account that the work of an expert in most cases should be a fifty-fifty split between the manufacturer and consumer of dyes). I refer to the spirit of co-operation and progressiveness. Having seriously considered something new in the market and having satisfied themselves that the thing looks good, the manufacturers go at it in a big, wholehearted way, for it is only in the mill that we technical men can find out whether the beaker lied or not. This is the spirit that leads and with the large resources at disposal you have succeeded in passing the old country in many instances as far as technical knowledge is concerned. We have now many naphthol friends this side of the ocean, and I have done almost as much learning as teaching in these last two years. An exchange of views and experiences is bound to remove obstacles and it gets the thing going.

Application Problems

Much has been said in words and in articles what naphthols are made of and what they look like, but comparatively little has been said of what they act like. Therefore, allow me, gentlemen, to tell you my side of the story, and let us leave the laboratory with its many problems and go right to the dyehouse with still *more* problems and see what we can do with these more or less abused naphthols. Let us then dwell a bit on these points which have been trouble-makers and let us see what we can do to retain the smile on the customer's face after he has rubbed a hole in his handkerchief (and perhaps his finger) in trying out the fastness to crocking, for instance. In trying to cover all possibilities of application, I am also trying to make a long story as short as I can and not to impose too much on your patience and time.

The field of introduction of naphthols in this country covers the plush and upholstery trade, ginghams, dress goods, shirtings, tickings, hammocks, towels and table cloths and wherever fast colors of great brilliancy are required. The naphthols are marching alongside the vats, without interfering with them. In several cases they supplement each other in producing shades which cannot very well be economically reproduced with straight vats or sulphurs, the latter on account of their inferior fastness. In regard to this combination we have made considerable headway and I will have to say a few words on this shortly. First, allow me to touch on the dyeing process itself and then go over the most suitable combination for warp, skein piece and machine dyeing. The solution of naphthols is very easily obtained, as you know they are pasted up with oil to disperse the colloidal naphthol and then caustic soda is added. The amounts of these two ingredients change, slightly, with various naphthols and have to be adjusted to the substantivity of the naphthols, as well as the process of dyeing.

Our new book in regard to the application of naphthols, which is ready for distribution, gives all the necessary specifications. The amount of caustic soda used is in excess of that theoretically necessary in order to get the formation of the sodium beta-naphtholate. The excess preserves the stability of the solution by providing an extra margin to compensate for the loss through the reaction of the caustic soda with the carbon dioxide of the air. Too much of it has a tendency to retard the coupling action and endanger the stability of the developing bath. Sulphonated castor oil is a good penetrative agent. It is advisable that any oil used should be free from ammonia.

The naphthol liquor decomposes gradually on standing. The first sign of such decomposition is a slight turbidity of the solution which, after a time, changes to precipitation. If the impregnation bath is in daily use, a decrease in strength will not be noticeable because of the fresh feeding of liquor. If the naphthol solution has not been used for some time, it is best to find out, by means of a test, whether it still yields the proper impregnation. A small quantity of glue retards decomposition. The naphthols of the non-substantive class are much more stable than the highly substantitive ones, which latter as they are practically exhausted, can be renewed for economical reasons anyway. A previous treatment of the material

before the impregnation by boiling it out with soda or caustic is only necessary or advisable on pressure machines and in some special cases. It also proves of advantage in the case of delicate shades or for the maintenance of the standing bath. Warps or loose cotton need no boiling out, and especially in the continuous process better penetration and depth are obtained if the material is entered dry. The time necessary for impregnation depends on the method of working. For machine and open-tub dyeing it can be extended to thirty and even forty-five minutes. In the continuous or padding operation a short passage out of a more concentrated liquor is fully sufficient. The temperature is usually kept at 120 to 140 deg. Fahr.

Temperature and Additions

The naphthols of the AS group possess, as to-day it is well known, a certain affinity to the fiber. In the case of beta-naphthol, the fiber is merely saturated with the solution, whereas the naphthols of the AS group actually dye the fiber. This property of dyeing the fiber is more pronounced at a colder temperature and decreases with increasing temperature—a valuable point to remember, in such cases where, as in the continuous operation, uniformity at both ends is to be desired. With the substantive Naphthols AS-SW and AS-BR, however, the substantivity at a lower temperature is so pronounced that for the reason of level results it is best to work at 140 deg. Fahr., and, in the case of the black combination, keep away from bronzy results. An addition of common or Glauber salt increases the absorption of the naphthols by the fiber. The salt is best added in solution to the diluted naphthol liquor.

An addition of formaldehyde to all naphthols, with the exception of AS-G and AS-BR, improves the resistance to the air. This addition should not be made above 140 deg. Fahr. AS-SW is especially sensitive to formaldehyde and it is advisable to cut down as much as possible (about 1 qt. in 100 gals.) and make this addition in a highly diluted state. Lately I have advised my friends to eliminate formaldehyde on AS-SW altogether, especially in such cases where the air exposure of the naphtholated material is of extremely short duration. If precipitation is caused by too strong an addition of formaldehyde, it cannot be redissolved. The substantive Naphthols AS-SW, AS-BR and to a certain degree, AS-TR, can be rinsed after the impregnation with 1 or 2 ounces of common salt per gallon. The addition of caustic soda which we formerly recommended with the salt, can be left out as, on AS-SW and AS-BR, there is no stripping action by this process, and as it is best to remove as much of the alkaline matter as possible before entering the developing bath. AS-TR needs a heavier percentage of salt and even at that shows a slight stripping action. This slight loss in depth of shade, however, is more than made up by the possibility that the beautiful Turkey Red shade can be exactly copied and, furthermore, this naphthol can be used for machine dyeing. After the naphtholated material is dehydrated in the best possible way (hydro-extraction, mangling or squeezing rolls), it is developed in a wet state.

In special cases, only where non-substantive naphthols are used and much importance is attached to the fastness to rubbing, the naphtholated material can be dried in between at not too high a temperature. This process of intermediate drying is principally applied to piece goods and for heavy shades. The forming of the color is carried out in the developing bath with the twenty bases or fifteen salts so far introduced in to the market. While the fast color salts are simply dissolved in plain water, the various bases, the quality of which has improved steadily, have to be diazotized according to the formula given. The addition of the base nitrite paste to the hydrochloric acid should be made slowly in order to avoid frothing and loss of nitrite caused through nitrous acid being formed too quickly.

The temperature of the diazotizing bath has to be kept as low as conditions permit, with the exception of Fast Red GL Base, Fast Garnet GC Base, and Fast Garnet GBC Base where the diazotation can be carried out more quickly at a temperature of 65 to 70 deg. Fahr. As the diazo solution during the diazotizing process has to contain free hydrochloric acid and an excess of nitrite, these reactions have to be verified with Congo Paper Blue and potassium iodide starch paper.

The neutralizing process should take place shortly before application with sodium acetate. Dye liquors containing free hydrochloric acid yield flat and streaky dyeings (a well known trouble-maker with GL or G Base).

Aftertreatment

The stability of the diazo solution varies from one hour or two with the Black LB Base to about one day for the other bases. They show the greatest stability as long as they react acid. It is, therefore, advisable to keep the solution in an acid condition until shortly before the application. Additions of alkali binding agents to the dye bath also increase the stability. These agents are acetic acid or formic acid for GL Base or aluminum sulphate. They remove the caustic soda carried into the dye bath and prevent the diazo solution from becoming alkaline. Acetic acid is the agent preferred as aluminum sulphate forms insoluble aluminum soap along with the oil carried over from the impregnation bath. In the case of Blue Salt B the caustic soda should be neutralized with bicarbonate of soda.

Great importance must be attached to the aftertreatment. The diazo solution must be entirely removed from the fiber by rinsing. With Black LB Base and Black Salt B the material is entered directly after developing into boiling soda ash. When using salts on heavy shades it is well to apply a short acidulation (muriatic acid), in order to destroy the aluminum soap formed on the fiber. After removal of the acid the material should be soaped hot and then rinsed hot and cold again. The boiling aftertreatment is essential to secure the proper fastness to crocking, as well as to fastness to light. There have been many complaints regarding the fastness to light of various combinations, especially in such cases where the padding or continuous process did not permit a more lengthy boiling. The most sensitive combination in this respect is AS-SW and KB Base. AS and GL is somewhat less affected and AS-RL and RL Base (in pinks as well as heavy shades) shows the least difference in fastness with a short or longer boiling aftertreatment.

In regard to the continuous operation, this fact represents a problem that has not been solved as yet, especially in such cases as the awning trade, where extreme fastness to light is required.

Developing

With the exception of Dianisidin Blue (Blue Salt B as a developing agent) an aftertreatment with bluestone has no influence on the light fastness. The most economical way, along with the possibility of obtaining high production, is the dyeing in the chain in the three to five box continuous machine. A very brilliant and rich shade of scarlet can be produced in this way at a cost of from 8 to 12 cents per pound for dyestuff and chemicals using AS in combination with GL salt. The impregnation process can be carried out in one run in one or two boxes with a squeeze in between which aids in penetration and depth of shade. If only a warp frame is at disposal this method can be simplified by giving the material two ends at one time in the naphthol bath by bringing the warps from the upper squeeze roll back over a special leader into the same impregnation bath again. As the warps are entered in a dry state the volume of the feeding liquor has to be adjusted to the liquor taken out by the dry material.

For 1,000 pounds of material, a naphthol volume of 100 gallons is fully sufficient. For naphthols of non-substantive type like AS, AS-BS, AS-BG and AS-G, and figuring with the speed of about 35 yards per minute and a temperature of 120 deg. Fahr., one-third of the entire solution should be added at the start and the remaining two-thirds along with the necessary volume of water should be fed during the operation. On larger batches the feeding has to be carried out proportionally heavier.

The highly substantive types of Naphthol AS-SW and AS-BR, as well as AS-RL and AS-BO in light shades, have to be fed much stronger, however, the proportions being 1:4 or 1:5. Great stress must be laid on a perfect squeeze action after the prepare. The squeeze rolls are best wrapped with burlap and the weighing down should be carried out to the highest possible extent without interfering with the smooth operation of the machine. If conveniences permit, an extra run through an empty box after the impregnation gives the benefit of an extra squeeze and tends to cool off the material. For substantive naphthols this box can again be used for the salt rinse, which removes surplus naphthol, as well as the oil and alkaline matter, and produces results very fast to crocking. For the developing action, with the exception of dark blue and black, one end in one box is fully sufficient to produce heavy shades and the feeding can be done on the same lines as with the impregnation. The aftertreatment is as before mentioned.

As far as the proportion of the developing salts necessary to develop the naphthol on the fiber is concerned, practical experience has shown that three times the amount of salt as naphthol is fully sufficient in every case and to every combination. Some of our friends get away with less and some use a trifle more as an extra safety precaution. The cost of the salt, if compared with the base, is, therefore, approximately the same, the advantage with the salt being simplicity and foolproofness.

I have, at this time, an announcement to make which should especially interest some of our Fast Red Salt GL customers. Also a perfect solution can easily be obtained. With this it has given cause for complaints in regard to foaming, particularly in cases where large quantities have to be brought into solution. I have just received word from our manufacturers that they have succeeded in doing away entirely with that disagreeable feature and that the new and improved product can soon be marketed. Our newer combinations using AS-SW and AS-BR as a foundation producing a wide range of shades from orange to red to maroon, blue and black can very well be dyed on any machines used in American dyehouses. As, with an addition of salt to the naphthol bath an exhaustion of 80 to 100 per cent can be obtained, there is no need of saving the liquor and machines with a comparatively large volume, like the Hussong, Klauder-Weldon or even the Brantwood, can now be considered for economical reproduction of medium and heavy shades.

The advantage of the salt rinse should be applied in every instance. For pressure machines at least two of these salt rinses should be given. As a salt rinse does away with the more or less risky hydroextracting of the material, especially as far as skein dyeing is concerned, yarn can be dyed in the open tub without removing the material from the sticks and with perfect fastness to

crocking. Mercerized yarn absorbs the naphthol much more intensely, necessitating weaker impregnation liquors. The quantity of Turkey Red oil in the naphthol bath should not exceed 8 to 10 c.c. per gallon in order to retain the luster of the material.

On Rayon

The same applies to rayon. Generally speaking, the naphthols have a still greater affinity on viscose than on mercerized material and the fastness to rubbing on rayon is, therefore, very good in practically all combinations. Mechanical aftertreatment of the material must be avoided and care should be taken that the liquor for the aftertreatment does not exceed a temperature of 140 to 150 deg. Fahr. If these points are observed the quality of the material should not be impaired and the luster retained. However, the naphthols show different properties in regard to affecting the luster. The best in line is AS-G. Then follow AS-BO, AS-SW, AS-BS, AS-TR, AS-BG, AS-D and AS-RL. The application of salt should be avoided, if possible.

Naphthols on Unweighted Silk

The preparation of the impregnation bath differs from that customary for cotton. As is well known, silk is extremely sensitive to alkalies, and it is, consequently, advisable to add a fiber-protecting agent to the caustic alkaline naphthol bath in order to fully prevent the alkali from attacking the fiber. This combining with the low temperature eliminates any danger in this respect. As a fiber-protecting agent Protectol produces the best results. An addition of this product to the naphthol bath not only preserves the luster, feel and tensil strength of the silk but the absorption of the naphthol is in no way retarded. In combination with freshly dissolved animal glue, the stability of the naphthols, which is somewhat diminished by the necessary reduction in the amount of Turkey Red oil, is improved. Protectol No. 1 Powder Double is the brand best adapted, but with due consideration to their respective concentrations the other brands on the market may also be applied.

Preparing the naphthol solution, for instance, 1 pound of naphthol is made into a paste with:

1 pound oil
1 pt. hot water
1½ pts. caustic soda, 60 deg. Tw.

After standing some time boil up with about 10 gallons hot water to a clear solution. Then add

6 ounces freshly dissolved glue.
12 ounces Protectol No. 1 Powder Double.

Previously dissolved in 5 gallons of hot water. This entire solution is poured into a volume of cold water. With the exception of AS-G and AS-BR, one quart of formaldehyde is added. The preparation of the developing bath is carried out exactly as for the dyeing of cotton, but the calcium and aluminum salts are omitted and the hydrochloric diazo solution is neutralized with sodium acetate instead. In the case of Fast Red GL Base, sodium formiate. It is very important to keep the developing bath more strongly acid than in the case of cotton, and, therefore, the addition of acetic or formic acid to the neutralized diazo solution should be more liberal.

Naphthols on Tin-Weighted Silk

Generally speaking, the same method of application is used as on unweighted silk. The naphthols are dissolved, as usual, but the solution should be allowed to stand overnight. Shortly before the impregnation, the solution is diluted to the desired volume with cold, soft water and with due allowance to the fact that on account of their still greater affinity to the fiber a further reduction in percentage is necessary. An addition of 60 c.c. sodium silicate per gallon of liquor is then made. Naphtholate 10 minutes without salt and treat for fifteen minutes more after an addition of 1 ounce of salt per gallon on a larger volume of liquor has been made. Hydro-extract or apply a salt rinse; develop and aftertreat in the usual manner.

With the exception of Naphthol AS-G and AS-BR all naphthols are suitable for tin-weighted silk. Raw silk can be degummed and naphtholated at the same time. Again an addition of Protectol No. 1 Powder Double along with freshly dissolved glue is made to the naphthol bath. Proportionally, 1 gallon should contain:

60 c.c. caustic, 50 deg. Tw.
1 oz. Protectol
1/3 oz. glue.

The amount of oil should not exceed 20 c.c. per gallon. Impregnate at a temperature of 120 deg. Fahr. Turn your skeins twice in twenty minutes, cool liquor down to 70 to 80 deg. Fahr. by increasing its volume and adding from 1 to 2 ounces common salt per gallon; continue the impregnation process for another twenty minutes; dehydrate and finish as usual. It is, of course, advisable to slightly scroop the material as a final operation. Piece goods, cotton, mercerized or silk are either impregnated in the jigger over the reel or in a 2- or 3-bowl mangle, impregnated at 120 deg. Fahr., substantive naphthols, at 140 deg. Fahr. Weight, squeeze and rinse as much as

possible to remove excess naphthol, oil and alkaline matter to insure good penetration. If padded, the feeding liquor must be heavier than the starting bath. This has to be regulated according to the substantivity of the naphthols. Dry in between only for heavy shades of non-substantive naphthols at not too high a temperature and develop immediately. The neutralized diazo solution is best fed from a storage tank in which by an addition of cracked ice a low temperature is maintained. To further safeguard a cold developing action, the saturated box made of hard rubber or Monel metal can be surrounded with a jacket containing ice and water.

The material passes the liquor between the mangle rolls and then a way should be found to apply a short skying operation to complete the coupling action. Rinse in cold water and aftertreat hot. Be sure of entire removal of diazo solution before decomposition occurs and soap best in a mechanical way, on rope soaper to remove all traces of lake formation. Too long a delay between rinsing and soaping slightly flattens the shade. For dyeing on pressure machines, Franklin, Brantwood, Hornsbuckle, and so on, boil out previously; cut down on the oil in the impregnating bath. Use substantive naphthols or other naphthols only in very light shades. Rinse twice with salt after naphthol and blow the beams in order to remove all traces or as much as possible of impregnating liquor. Develop and finish as usual.

Raw cotton on machines work on the same lines. Cut still more down on the oil or replace part of it with Nekal-A-Dry to obtain a smooth paste with the naphthol; give two salt rinses; develop and aftertreat as usual, replacing the soap with soda ash or a small percentage of caustic. Give a final treatment for about ten to fifteen minutes at a temperature of 130 deg. Fahr. with a little Glauber salt and, perhaps, glycerine, to aid in remoistening the material after drying.

In observing these items, the former trouble in regard to spinning and winding can be entirely overcome.

Combinations

I think I have pretty nearly covered the field and methods of application as far as straight naphthol combinations are concerned. I might mention, at this point, that various naphthols, as well as bases, or developing salts, can be mixed with good results, to obtain certain shades. In mixing naphthols, it is advisable to only combine products of the same substantivity. Therefore, AS can very well be mixed with AS-BS or AS-G or AS-RL. AS-BO with AS-TR or AS-BG with AS-G or the substantive brand AS-SW with AS-BR.

For continuous work especially close attention has to be paid to combining naphthols of the same character. Various of our customers have had very good success in mixing bases or salts. Even mixtures of blue and red salt have worked very uniformly. I should advise combinations of this type only for such cases where straight combinations fail to produce the shade desired.

I do not wish to close my paper without making a few remarks in reference to what has so far been accomplished by combining naphthols with vats or sulphur colors. These combinations, of course, only enter the field of practical application in such cases where it is difficult to produce depth and brightness with straight vats or where the cost of straight vats is prohibitive. In combining these two groups of colors, special attention has to be paid to the all-around fastness of the products. I refer to heavy brown, maroon or dark green shades.

Where the general fastness to chemicals and chloride of lime is not essential, sulphur colors can also be very well applied in conjunction with naphthols, either in the same bath along with substantive naphthols, or topped afterwards. The rinsing operation in salt removes the excess naphthol along with the sodium sulphide and alkaline matter and the developing action can be applied afterwards. Vat colors can also be worked in the same bath with naphthols after they have been separately brought to a reduction. The salt rinse can then be made with an addition of perborate to assist oxidation. Larger, practical tests, however, have shown that if these two groups are combined in one bath, and are immediately developed, the effect of the vat color is partly destroyed. This is especially evident in such cases where the material was not allowed to oxidize on the air for a certain period before the developing operation.

We are still working out this proposition and several important manufacturers are co-operating to further simplify the process, having the object in view to obtain certain heavy shades economically and with good, all-around fastness.

Since the field of application of naphthols is constantly widening, there may be many more points for discussion but, on general lines, I think I have touched the subject at almost every angle. The naphthol consumer, in practically every case, ran into similar obstacles and with the instinct of the dyer to overcome trouble, has recognized mostly on his own hook the little tricks and trouble-makers to get consistently good results. We all are still learning in regard to the application of this newest group of colors; in fact, we never finish learning in our business, as far as any group of colors is concerned. This, I dare say, is the "sunny" side of our colorful occupation.

I thank you, gentlemen, for your patience and kind attention.

. . . At this point Vice-Chairman Samuel L. Hayes assumed the chair. . . .

Chairman Hayes—I know that Mr. Marsson will be very glad to answer any questions you may have on this subject. Are there any questions? I don't want to wait too long, but at the same time I don't want to cut out any questions. (No questions were asked.) I am sure we all enjoyed Mr. Marsson's paper very much, and as there do not seem to be any questions in the minds of the members, we will proceed.

It was my good fortune one afternoon last summer to spend some time in the Fleischmann Laboratory out on the Grand Concourse with Mr. S. W. Fiske. I spent an exceedingly interesting afternoon and I have no doubt that Mr. Fiske's talk to-night will also be exceedingly interesting. I have great pleasure in introducing Mr. S. W. Fiske, of the Fleischmann Company, who will speak on "The Enzymes of Diastase in the Textile Industry."

. . . Mr. Fiske presented his prepared paper:

The Enzymes of Diastase in the Textile Industry

By S. W. Fiske
The Fleischmann Company

Mr. Chairman: The pleasure of being with you is marred only by my own limitations.

When our good friend, Dr. Pickrell, asked me to be your guest and make a speech, while filled with feelings of sympathy *for you*, I was, nevertheless, tremendously complimented. And then he went on to say he wanted me to talk on the subject of enzymes, and my elation, more or less, gave way to despair. I was like the man, who, unfortunately, did not get along very well with his wife, and in the midst of one of their periodical arguments, said to her, "If you should die, what carriage should I ride in at the funeral," and she replied, indignant, "Why, there is only one proper place for you to ride, and that would be in the first carriage with my mother." "I can't do that," he said, "it's impossible—I haven't spoken to your mother for years." "It doesn't make any difference,' said his wife, "that is the proper carriage for you to ride in—the first carriage with my mother." "Well," said the husband resignedly, "if I must, I must, but it will spoil my whole day's pleasure."

That expresses some of my feelings when the good doctor prescribed enzymes for me.

I reminded Dr. Pickrell in all fairness that the enzyme family is a large family, but that years ago when I lived in the Middle West, I used to know some of the Ohio enzymes fairly well. Consequently I asked for permission to tamper with my subject, and as this permission was allowed, I shall talk to you of a specific enzyme. Through the courtesy of Dr. Pickrell and your committee, Dr. Ralph E. Lee will talk to you on this subject more in detail. He knows the whole—family.

I have said that in the past I was acquainted with some of the Ohio enzymes and I call them that because nineteen years ago the company I represented in Cincinnati introduced into this country for use in the textile mills a product containing the active enzyme of diastase. This product was called Diastafor, a diastatic malt extract, under which name it was then already manufactured and marketed in Germany, Austria, Great Britain, France and Italy. As far as the mill man was concerned, the malt extract had no interest for him, *per se;* it served, however, as a carrier for this enzyme and it was our purpose to introduce it to the mills of the Western Hemisphere for three purposes:

The first was for the preparation of a size for cotton warps. One action of this enzyme on starch, which is the body of such sizing pastes, is to convert the starch quickly and efficiently into a soluble form, so that warps sized in this solution would not only show less dusting on the looms, because of the increased penetration due to the conversion of the starch, but would show very much less breakage. Moreover, time would be saved in the preparation of the sizing paste. Tallows and gums or other softeners, if not alkaline, could be added to the paste if desired. The preparation of such sizes was comparatively simple. The product acted quickly and efficiently at temperatures of from 140 to 150 deg. Fahr., while temperatures of over 170 degrees lessened the diastatic action until finally it was killed at the boiling point. That was the first use for which we introduced this enzymic product.

The second use had as its principle, also, the conversion of starch, and took place in the stripping or desizing operation before dyeing or bleaching. We knew that certain grades of materials had to be freed of their warp sizing to insure even dyeing, and the action of this enzyme of diastase afforded a quick, reliable and beneficial means of accomplishing that result with no injury whatever to the fiber and in considerably shorter time. The proportions in which we recommended the use of the product was from five to ten pounds to a hundred gallons of water, depending on how heavily the goods to be treated were sized and the length of time possible to give to this operation. The temperature of wetting out (cool or hot) would have some bearing on the length of time goods stand. The process was to run the goods into a bath containing the enzymic product, in proportions as given, so that the goods were thoroughly wet out. We recommended the temperature of the bath to be from 140 to 150 deg. Fahr., at which temperatures the enzyme was most active. After getting a thorough wetting out in this bath, the goods were allowed to stand from one to three hours and were then rinsed, after which the starch was effectively removed, and subsequent operations could proceed with the assurance of even dyeing.

The third use for the product, similar to the first, was the preparation of finishing pastes and print thickeners. The product here is used in varying amounts, depending on the paste desired.

Now, of course, in time, we have discovered other uses for this product with this enzyme of diastase, some indeed outside of the textile industry, and, while as far as the textile field was concerned, it was our original idea that this product would be used on cotton, we have conducted experiments on other fabrics and fibers with more or less satisfactory results.

We have discovered, too, that while the product has proven a boon to many mills, it is not necessary at all times and sometimes even undesirable. Further, the most popular use of it seems to be in the second class or for the purpose of stripping.

It is not only a pleasure, but an opportunity for me to come here and talk to you on this matter, not by any means from a trade standpoint or a standpoint of selling, but so that we, who are intensely interested in finding new uses for this article, can avail ourselves of the chance your courtesy has provided to discuss the matter with you, and, we hope, interest you to the point where you will from time to time offer us suggestions that we can pass on to others in the trade, who would be benefited by the introduction of such an article.

I said at the outset that my pleasure at being here was marred only by my own limitations, and I frankly feel that you are entitled to an apology from me for not discussing in more detail and in a broader scope the subject originally assigned me. If I may so express it, I have served merely as an appetizer. Dr. Lee will be able to give you the entree, and I am confident you will enjoy and appreciate it.

Thank you.

Chairman Hayes—With the permission of those present, I will not call for questions now, but will wait until Dr. Lee finishes his paper and then we will let Dr. Lee and Mr. Fiske fight over who will answer the questions.

I take great pleasure in introducing Dr. Ralph E. Lee, also of the Fleischmann Company, who will discuss the matter of enzymes in general. I don't know whether he will take up pre-Volstead enzymes or not. I had hoped Mr. Fiske would, but he didn't. (Laughter and applause.)

Dr. Ralph E. Lee—I heard someone remark when they were told that we were going to be here that "two wise men from the yeast were here." (Laughter.) I don't know about the wisdom, but they are from the yeast all right. (Laughter.) I suppose I was asked to talk on enzymes because I am a yeast man.

As you know, yeast has been used as a raw material for the supply of enzymes to those who are studying these interesting compounds, and it may interest you to know that we are supplying at the present time over fifty universities and colleges with yeast in varying quantities from a few pounds up to several thousand pounds a year, for the study of enzymes.

I come before you with some trepidation because it was difficult to know just where to begin my story. After some consideration, I thought it best to begin at the beginning, so if part of my paper seems rather elementary to some of you, I must ask your indulgence and patience for the sake of those who are not so familiar with the general subject.

. . . Dr. Lee then presented his prepared paper:

The Enzymes

By Dr. R. E. Lee

Director, Department of Applied Research, the Fleischmann Company.

Enzymes can be discussed from various angles. We can study the substratum and the relation of the enzyme to it. We can take up the mathematics of the enzymes, the rate of acceleration, and so forth, produced by them, and show by curves and mathematical formulae their action, or we could study the enzyme itself, its concentration, its purification, looking toward the ultimate isolation. It is obvious that in a paper that is to cover the whole subject of enzymes, it is possible to approach it from these angles, and what I want to give you is rather a superficial survey of the whole field of enzymes and enzyme action.

It is difficult to overestimate the importance of enzymes to mankind, and if we but draw up a rough list of enzymatic activities concerned with our every day living, this importance is at once apparent. The digestion of all of the food we eat, from the proverbial "soup to nuts," with the exception of some of the simple sugars, is accomplished by numerous enzymes distributed throughout the digestive tract; after the food has been successfully digested and absorbed, its actual utilization by the various tissues occurs only if the many varied enzymes of the tissues are in normal working order; the germination of the seeds of plants, the growth of the plants themselves, the storage of starch in the potato, of protein in wheat, of oil in the olive, and of sugar in the grape; all of these are made possible by the activity of enzymes. The very machinery of life itself, from that of the tiniest of the bacterial forms, to that of the mightiest dinosaur of prehistoric ages, seems to be run by enzymes, and after life is ended the manifold changes of decay are brought about by the combined action of enzymes manufactured by the bacteria, whose duty it is to tear down "this mortal flesh" into the "ninety-eight cents worth" of carbon, hydrogen,

nitrogen, oxygen, lime, phosphorus, iron, etc., of which it is supposedly composed.

Enzymes as Catalysts

It is rather difficult to define enzymes in a clear cut and thoroughly satisfactory manner, and as a result of this difficulty different workers in the enzyme field have proposed different definitions. Sir W. M. Bayliss gives a very simple one which is perhaps most logical. He defines them as "the catalysts produced by living organisms."

To get a clear conception as to what we mean by the term "catalyst," let us remember that we may conveniently divide all chemical reactions into two classes:

1. Those reactions which take place almost instantaneously as, for example, the immediate precipitation of silver chloride that occurs when silver nitrate solution is added to a solution of sodium chloride, and

2. Reactions which take a measurable time to arrive at a final state, as, for example, the formation of soaps by the long continued boiling of fats with alkali.

Now a "catalyst" is a substance which is capable of altering the rate of a reaction of this second class, and furthermore, of doing so by its mere presence and without combining with or being changed by the other reacting substances.

There are a great many catalysts, of course, both inorganic catalysts and enzymes, and many very important industries are founded upon catalytic reactions. Some of the industrial applications of *enzymatic* processes we shall discuss a little later. The manufacture of sulphuric acid by the contact process, and the hydrogenation of vegetable oils are two very important procedures in which *inorganic catalysts* are used. There are many others, some of which are used in your own industry.

A very interesting fact in relation to these catalytic agents is that a very minute quantity of the catalyst is able to influence enormous quantities of reacting material, and furthermore is able to alter enormously the rate of change. For example, 1 part of the rennin of commerce, widely used in the preparation of junket, is able to coagulate from 2,500 to 3,500 parts of fresh milk. In the making of cheese the rennin is not used at quite as high a dilution as this. The actual practice calls for about 3 ounces of rennin for 1,000 pounds of milk. At this dilution 1 part rennin coagulates a little over 5,000 parts of milk. In illustration of the great alteration in rate of chemical changes brought about by catalysts let us consider the decomposition of hydrogen peroxide, familiar as a household remedy. Hydrogen peroxide if left to itself will decompose very slowly into water and oxygen, but the rate of decomposition is so slow that we may buy a bottle of peroxide at the drug store and keep it for months without its suffering appreciable deterioration. If, however, we pour a little of the peroxide into an open wound, it undergoes such a rapid decomposition that the liberated oxygen produces a pronounced foaming. This greatly accelerated decomposition is due to the presence, in the tissue juices, of a catalyst, and this catalyst is, according to our definition, an enzyme because it is produced by the tissue cells, which are living organisms. The catalyst rennin, which we mentioned a moment ago, is produced in the stomach of calves, and it also, of course, is an enzyme.

Origin of the Term

The events which led up to the coinage of the term "enzyme" may be of interest to you:

In 1830 Dubrunfaut had prepared an extract of malt which converted starch into sugar, and three years later Payen and Persoz precipitated by alcohol from such extracts a substance which could be dried and preserved, and which had a very powerful action on starch. They called it *diastase*.

As more bodies of similar properties became known, they were called "ferments," on account of the resemblance of their activities to those of alcoholic fermentation.

Since the earliest days of chemistry a great deal of attention had been paid to the process of alcoholic fermentation, and many conflicting explanations of the process were advanced by different investigators.

Later, when Pasteur had shown alcoholic fermentation to be due to a living organism, diastase and bodies like it were called "soluble or unorganized ferments" to distinguish them from living organisms, like yeast, which went by the name of "organized ferments."

It was believed by many workers that the conversion of sugar into alcohol was inseparably linked with the *life* of the yeast cell, and the use of the term "ferment" to designate both living things, like yeast, and non-living things, like diastase and pepsin, led to considerable confusion. Therefore Kuhne, in 1878, proposed the name "enzyme" (from the Greek words meaning "in yeast") to include all such catalytic substances.

Nearly twenty years later, in 1897, Buchner noted that some yeast juice, which had been prepared completely free from yeast cells, was capable of actively fermenting sugar solutions with the formation of alcohol and carbon dioxide. This, and some confirmatory experiments, proved conclusively that alcoholic fermentation was not directly dependent upon the life of the yeast plant, and Buchner's conclusion was this: "The fermentative power of yeast is due to the presence of a dissolved substance." This active substance he called "zymase." It is now generally accepted that the action of any enzyme is independent of the life of the organism which produces that enzyme.

The effects of this newer conception have been very far reaching. Buchner's work greatly stimulated enzyme research and biological research in general, and we now recognize many enzymes and know a great deal about how they act, although we know but little as to their exact chemical nature. Because of this we have no chemical tests for use in their identification, but instead, for recognition of them, must give them "some work to do," arrange conditions of temperature, acidity or alkalinity, etc., so that the work can be done and then, after a suitable time, look to see if the work has been done. If we find the work done, we conclude that the enzyme in question was present in the material under examination, and if we find the work not done, we conclude that the enzyme was not present. The quantity of enzyme present is determined by measuring the amount of work done—the more enzyme present the more work done, within limits, is the general rule. I want to say a bit more about quantitative determinations a little later.

A very striking characteristic of enzymes is their so-called "specificity." As a general rule, any given enzyme has one particular job which it can do, and only one. It is a specialist raised to the *nth* degree. There are no "Jacks of all trades" among the enzymes. The enzyme which so enormously hastens the decomposition of hydrogen peroxide does just that one thing most effectively, and the enzyme which speeds up the decomposition of sugar into alcohol and carbon dioxide is absolutely "the best man in the world" for that particular job; but, if these two are switched about—the zymase is placed with the peroxide and the tissue catalase brought into contact with the sugar—neither of them does a tap of work. We get neither decomposition of peroxide nor production of alcohol and carbon dioxide. It is the same with all other enzymes.

The specificity of action of the enzymes is made the chief basis of their classification and nomenclature. They are for the most part named according to the substances upon which they act, and to a less extent with reference to where they are found or the conditions under which they operate.

The group of enzymes which hydrolyze carbohydrates are called carbohydrases, those acting upon proteins, proteases. The fat-splitting are called lipases, after the Greek word "lipos," meaning fat.

Each of these classes of enzymes contains many members, some of which may be grouped into subclasses. For example, of the carbohydrases there are several whose function it is to convert starch into less complex carbohydrates. These starch splitters are classed as amylases, the term being derived from "amylum," the Latin word meaning starch.

One of these amylases is *ptyalin,* or salivary amylase. As its name indicates, it occurs as one of the constituents of saliva and is there for the purpose of starting the digestion of starch in the food we eat. An interesting fact in this connection is that there is no ptyalin in the saliva of dogs, although it is found in the saliva of most other animals.

Any starch which escapes the action of ptyalin during ordinary digestion is acted upon in the intestine by another amylase. This one is known as *amylopsin* or pancreatic amylase and is produced by the pancreas, a gland lying alongside the intestine, just below the stomach. You are probably more familiar with this gland as it appears on the menu under the title of "sweet breads on casserole" than as a maker of enzymes.

Diastase in Starch

Another amylase in which we are all much interested is *malt diastase,* which is, of course, a vegetable amylase, produced by the cells of the barley seed as it begins to germinate. The starch in the barley is stored there by the plant before it goes to seed with the idea that when the time comes for the seed to sprout, it may have a supply of energy and material for sustaining growth until it can get its little green shoot above ground and begin to utilize the energy of sunlight.

Before the seed can use the stored starch, it is first necessary for the starch to be broken down from its very complex form into the form of simple sugars, and for the accomplishment of this change, the seed calls upon the services of the diastase, which is brought into existence by warmth and moisture.

In this respect, of course, the seed has nothing on the textile manufacturer, who does just the same thing. When he has some stubborn starch to be liquefied he calls into action the same diastase and it works for him just as well as it worked for its former employer, the original barley seed.

It might be well at this point to digress a bit and look at some of the changes which occur while the starch is being transformed. We'll come back to our enzymes in a moment.

The starch grains as they exist in their raw or natural condition are encased in a thin envelope of paper-like material, and this material is resistant to the action of diastase. However, in almost all cases, diastase has his "good man Friday" along with him in the person of another enzyme called *cytase,* and while Friday doesn't often get credit for an "assist," nevertheless, he is the fellow who attacks the envelope and exposes the enclosed starch to the action of diastase. The ensuing processes are decidedly complicated, but for present purposes may be outlined as follows:

At first the starch molecules take on water and are converted into the less complex soluble starch which gives

a water-clear solution instead of one having the opalescent characteristics of ordinary starch. This material still gives a blue color if treated with iodine. As the hydrolysis continues, erythro-dextrin is formed—so called because it gives a red color with iodine—and then a series of dextrins which give no color with iodine, and as the splitting continues, the final product is maltose, or malt sugar.

The dyer, finisher or weaver of textiles or any other textile manufacturer is not particularly interested in changing the starch into sugar. The textile man is satisfied to get his starch into a soluble form so that he can wash it out readily, if he is trying to get rid of it; or get an even distribution of it, if he is putting it into the goods. It is to his advantage to control the conditions under which his diastase is operating so that this objective is more readily reached. He can then easily stop the action by raising the temperature to a point at which the enzyme is no longer able to act. Little or no damage can result if the process goes too far in desizing, because maltose is more soluble than the dextrins, but when diastase is used in the preparation of material to be employed in "sizing," it is necessary that the hydrolysis be stopped at the proper time.

Three sugars which are very important in the welfare of men are: sucrose—ordinary cane sugar, maltose or malt sugar, and lactose or milk sugar. As these sugars must be broken down into simpler sugars before they may be used as sources of energy, we find, scattered about through nature, specific enzymes for the purpose of breaking them down. The enzymes are called *sucrase*, *maltase* and *lactase*, respectively. Sucrase is very frequently called *invertase*, which, by the way, isn't a particularly good name for it, but will probably stick to it nevertheless. It is called invertase because the mixture of glucose and fructose, which are formed when cane sugar is broken down by its action, is known as invert sugar.

All three of these enzymes, sucrase, maltase and lactase, are found in the intestinal tract of man and other animals, as well as elsewhere. Maltase, for example, as might be expected, is found in malt and is the substance in malt preparations responsible for the conversion of maltose into glucose. This action is a ccontinuation of the general one of starch hydrolysis which we discussed a moment ago.

An interesting thing about our bakers' yeast is that while it contains both sucrase and maltase, it does not contain any lactase. This accounts for the fact that it does not have the ability to ferment lactose, but does have the power to ferment sucrose and maltose.

As a matter of fact, all this time we have been journeying hither and yon in the digestive tract and out again searching for enzymes about which to talk, we have been running up a lot of unnecessary mileage. We might just about as well have limited our discussion to the enzymes found in yeast, because in yeast we find most of the kinds we have mentioned and a lot more besides.

Speaking of yeast suggests alcoholic fermentation, and that brings us back to zymase which in many ways may be considered the chief enzyme of yeast, and about which we spoke a little while ago in connection with the classic discovery of Buchner.

It is zymase that converts the simple sugar, glucose, into alcohol and carbon dioxide.

Enzymes in Digestion

Of the *proteases*—those enzymes which speed up changes in protein materials—there are many, but I want to mention briefly only four of them. One of them is *pepsin*, which is normally secreted by the glands in the stomach. It is sometimes termed gastric protease and is also called acid protease because of the fact that it works in an acid medium. Its function is to start the digestion of the protein of our food and while, if given time enough, it can finish what it starts, it is not given a chance to do so ordinarily because the food leaves the stomach and passes along into the small intestine too quickly.

The work of digestion started by pepsin is carried on in the intestine by the enzyme *trypsin*, which is sometimes called pancreatic protease because it is manufactured by the pancreas, and also alkali protease, because it works in an alkaline medium. There are other intestinal proteases that we have neither the time nor the inclination to talk about right now.

Rennin, the protease which is so important in coagulating milk, we have already talked about. Another coagulating protease to which thanks are due for our very life, is in many ways similar to rennin. It is called *thrombin*, and it comes into existence when we cut a finger or start bleeding in any other way. The flow of blood stops when the injured blood vessel is plugged up by a blood clot, and unless the formation of such a clot occurs in each blood vessel that has been injured, the bleeding continues. The clotting is produced by the presence of thrombin and its action upon one of the important blood proteins, and does not occur if no thrombin is formed, so it is easy to picture the disastrous results that would follow even the slightest bleeding wound if we were not provided with the means of making this enzyme in time of need.

Let us return to the pancreas for a moment. Among its many other duties, one job consists in the manufacture of a fat-splitting enzyme belonging to the class of *lipases*. This particular lipase is known as *steapsin*, or sometimes as pancreatic lipase to distinguish him from the various

vegetable lipases which are found in plants, especially in oily seeds, such as the castor bean, where in all probability they are instrumental in making castor oil.

This brings us to another interesting phase of enzyme activity. The chief function of pancreatic lipase seems, at first glance, to be the breaking down of fats into glycerine and fatty acids, but under slightly different conditions it can take these decomposition products of a fat and rebuild them into the original fat. We have been talking all this time about the breaking-down sections of enzymes, but it is probable that all these reactions of decomposition are reversible and that under slightly different conditions as to concentrations of reacting substances, they may proceed in the opposite direction and bring about the formation of more complex substances from simple ones.

This building-up power has been definitely shown for some few enzymes. Maltase, for example, can under certain conditions bring about the formation of a molecule of maltose from two molecules of glucose, whereas, when we meet it ordinarily it is headed in the opposite direction and is breaking-down each molecule of maltose into two molecules of the simpler sugar, glucose.

Enzymes of another very important class are called *oxidases*, or oxidizing enzymes. They are found widely distributed in the tissue fluids of plants and animals, and are the agents which make possible the combustion of the sugars and fats which we eat, and the transformation of the energy contained in those foods into heat energy to keep us warm, and mechanical energy to do our muscular work.

Catalase, which we talked about as the enzyme capable of setting free the oxygen contained in hydrogen peroxide, is an oxidase.

Associated with the oxidizing enzymes, we find reducing enzymes or *reductases*. It is possible that these reductases are merely corresponding oxidases "driving in reverse," as oxidizing and reducing reactions always go hand in hand.

One other class of enzymes I must mention: the *deaminizing enzymes*, which split off ammonia from protein and other nitrogenous materials. One of these enzymes, called *urease*, plays an important role in converting urea into ammonium carbonate, thus making the nitrogen available for plant growth. Urease, by the way, has just recently burst into print, because of its having been isolated in a pure crystalline condition. Sumner, of Cornell Medical School, gets the credit for the accomplishment. Urease is the first of the enzymes to be prepared in a pure condition, and while we are still a long way from knowing just what urease is, from a chemical standpoint, getting it pure is a big step in the right direction.

One very moot question among workers in enzyme research has been the question as to whether enzymes are protein in nature, and considerable evidence has accumulated both for and against this supposition. Osborne obtained a highly active invertase preparation which gave virtually none of the protein reactions. Sumner, on the other hand, finds that his urease is protein in character. Pribram concluded that a malt diastase preparation he made was a mixture of protein and carbohydrates, but Beijerinck, a Dutch worker, found that an amylase could not furnish either carbohydrate or protein in satisfying the nutritive needs of yeasts or bacteria.

Haehn, a German worker, has reported the synthesis of two substances possessed of apparent enzyme characteristics. One has the properties of an amylase and the other of an oxidase. Each was partly protein in character.

Hopkins, an English scientist, has isolated from tissues a substance, resembling the oxidizing enzymes, which he calls glutathione.

Sherman, at Columbia, has succeeded in purifying an amylase to such an extent that it is active in a dilution of one to one hundred million, and would in thirty minutes, at 40 deg. Cent., split twenty thousand times its own weight of starch.

This enzyme is another one that appears to be protein-like in nature, and while the true chemical structure of enzymes is at the present time unknown, it is probable that they vary widely and that some are proteins while others are not.

The Enzymes in Industry

So far, most of our discussion relative to the importance of enzymes has centered around their activities in our bodies, especially in the digestion of our foods. It may be of interest if we take a look at some of the uses to which enzymes are put in the great world of industry.

The use of malt enzymes in the fabrication and handling of textiles you know about, of course, although I want to emphasize a few points in that connection a little later. In addition to their application to textile problems, enzymes find a wide use in industries of various sorts, and in a number of instances the entire foundation of the industry rests upon the activities of an enzyme or of a group of enzymes. The brewing and distilling of alcoholic beverages are processes, the chief basis of which is the splitting of glucose into alcohol and carbon dioxide as catalyzed by zymase. This same enzyme shares with a number of other important ones found in yeast, in the job of converting a more or less insipid mixture of flour, water, sugar, lard, etc., into a doubt which upon baking yields a delicious loaf of bread.

In the making of vinegar, the enzymatic processes involved take place in two stages, the first of which is the

formation of alcohol from sugar by the zymase of yeast and the second of which consists in the action of bacterial oxidases upon the alcohol, to oxidize it into acetic acid.

The commercial production of *lactic acid*, the industrial uses of which are widespread, is brought about by drafting the services of an enzyme manufactured by the lactic acid bacillus—the fellow who incites us to acts of violence when he has been at work in the morning's bottle of milk.

The use of the enzyme rennin for the coagulation of milk in cheese making, we mentioned. In the ripening of the curd, many other enzymes produced by bacteria or molds, come into play in giving the finished cheeses their wide variety of flavors and odors.

Back on the farm, enormous quantities of corn stalks are subjected to the action of bacterial enzymes in the silos, and are thus transformed into ensilage. This process saves for use as animal food a great deal of material which otherwise would be of use only as fertilizer.

During the war the demand for acetone, for use as a solvent in the manufacture of explosives and in the preparation of "dope" for the wings of airplanes, was so far in excess of the supply that a frantic call was sent out for some better way of producing it. Once again, enzymes were set to work and a process employing bacterial enzymes was developed, which has since helped in turning topsy-turvy the industry of hard wood distillation from whence most of our acetone formerly came.

As you see, in most of the industrial operations mentioned, the enzymes are used accompanied by the yeast or bacteria or molds which produce them. There are cases and there will be more in the future in which this will be a disadvantage, and then convenient ways will have to be devised for getting the enzymes separated from the cells which make them, just as is now done in the manufacture of diastatic preparations of malt. Considerable progress is being made in that direction at the present time, and more will surely follow.

All this time we have been considering enzymes in a rather general way, and in closing this talk I would like to bring it a little nearer to home, amplifying a bit, perhaps, what Mr. Fiske has said about the direct application of enzymes to the textile industry.

Let us consider for a moment the manufacturer of the diastatic preparation itself. Remember, that during the germination of the grain its cells produce an abundant supply of enzymes intended to be used in breaking down the starch of the grain, preparatory to its use as fuel by the growing seedling. By heating this partly sprouted grain, germination is halted and the malt is then ready to be put to any of its various uses. It may be ground and used as such in the form of a malt flour for various purposes, or the soluble materials in it may be extracted and used in the form of the extract. Let us confine our attention to this second procedure.

In extracting this material with water, the substances which we obtain in our final extract will vary widely according to the conditions under which we make the extraction. In general, two types of product result. One will be high in enzyme concentration and will contain but little sugar or nitrogenous substance. This is the type which is of interest to the textile manufacturer. The other will more or less represent the reverse of those proportions and will be high in sugar and nitrogenous substances, but will have a low enzyme content. It is this type which is of most value to the baker.

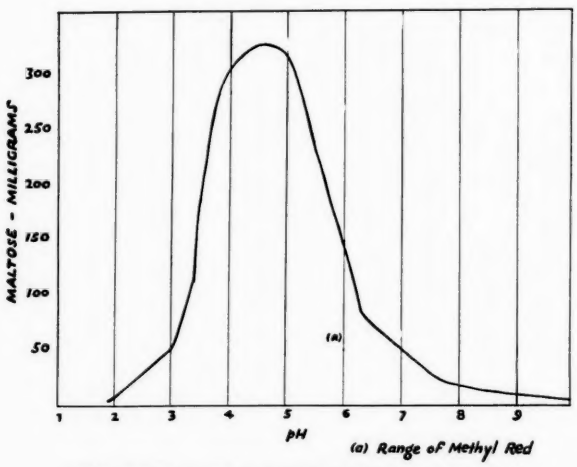
Effect of Temperature on Enzymes

The chief point of difference in the preparation of these two kinds of extracts is that, in one case, cold mashing is employed, during which process the highly active enzymes are dissolved without having had an opportunity to change much of the starch into sugar and with little or no impairment of their own power. In the other procedure, hot mashing is employed in liquefying and saccharifying, with the result that nearly all the malt starch is changed to sugar, but also with the result that the enzymes themselves are nearly destroyed by the continued high temperature.

Great care is, of course, necessary in preparing the highly diastatic extract in order to prevent the destruction of the enzymes. Enzymes in general are decidedly unstable substances and not only work best under certain conditions of concentration, temperature, and degree of acidity or alkalinity, but are often greatly weakened or, indeed, completely destroyed by seemingly slight variations from the optimum of these conditions. This is particularly true with respect to increase in temperature and too great a change in acidity or alkalinity. The stability of the product is so vital that our research men have devoted a great deal of time to just that problem of getting one that will keep. I am happy to be able to say that they have solved the problem, and have enabled us to turn out a product that does keep.

It doesn't do any particular good to use a product as stable as the rock of Gibraltar and with the highest possible diastatic power, if you fail to so regulate the conditions of temperature and reaction to approximate the optimum. These conditions are easily attained, and it is a comparatively simple matter to check up at any time to see whether or not they are being maintained. Mr. Fiske has told you the temperature conditions to be observed, and I would like to add that the reaction of the bath during the action of the enzyme is of great importance, too, if the best results are to be obtained. At a temperature of 65 deg. Cent. (150 deg. Fahr.) the pH value for

optimum activity is almost exactly 5.0* and the activity falls off rapidly either side of this point, with the fall being somewhat less marked toward the neutral point and decidedly steep in the other direction, that is, as the pH is lowered and the material becomes more acid.



RELATION OF DIASTASIC ACTIVITY TO pH

One more point of interest to you may be the method we use in measuring the effectiveness of Diastafor. I don't think the detailed description of the method is necessary at this time, so I'll limit my description to the general principles involved.

As the liquefying power of the material is of more importance to the textile man than the saccharifying power, the method was devised for measuring that power in particular. In general, the method consists of adding a measured quantity of malt extract to a definite quantity of starch and water and keeping the mixture at 65 deg. Cent. for half an hour, during which time gelatinization and a certain amount of liquefaction take place. The action of the enzyme is then stopped by the addition of sodium hydroxide. Next, the degree of liquefaction is measured by determining the viscosity of the material using as an index its rate of flow from a standard viscosity pipette. This rate is compared with a chart giving a curve obtained experimentally which shows the relation of "degrees of liquefying power" to outflow in seconds. The method has been found to be by far the most satisfactory one available and is capable of giving close checks when used by different analysts.

If at any time any of you are interested and would like to know the details of the procedure, drop us a line and we shall be pleased to help you out.

*Diastafor is adjusted to pH; equals 5.0 when manufactured.

Discussion

Chairman Hayes—We are certainly deeply indebted to Dr. Lee for his very thorough and interesting paper.

Are there any questions you would like to ask either Dr. Lee or Mr. Fiske?

I should like to ask Dr. Lee a question. Dr. Lee, you spoke of the enzymes being destroyed (I understood you to say that) when a certain temperature was reached. Are they actually destroyed?

Dr. Lee—Yes, they are destroyed and cannot be brought back, even by reducing the temperature. At 170 deg. Fahr a coagulation takes place, or a change takes place (if it is protein, it is probably coagulation). So that they are denaturized, as we say, and cannot be brought back by dropping the temperature.

Chairman Hayes—Are there any other questions for Dr. Lee or Mr. Fiske?

Mr. Herrmann—My attention was recently directed to a process in use at a mill in the preparation of a very heavy cotton fabric for dyeing. This cotton fabric did not contain any size, and yet the mill found it necessary to apply Diastafor or a similar malt preparation in order to so prepare the fabric that it would dye evenly. The superintendent claimed to have used all sorts of oils and alkalies and severe boiling treatments, which either had the result of not doing the work sufficiently or of injuring the fabric, which was a rather delicate one, although it was heavy in structure.

I was wondering whether the action of the malt there was quite apart from its chief function, whether there was present in the malt some enzyme other than the zymase, because we were not confronted with a condition there of a starch solubilizing, but we were treating to break through the cotton wax or keratin, and trying to do something quite different.

Dr. Lee—Besides the diastase that is in malt, the Diastafor is very rich in proteases. All malt extracts, for that matter, contain quite a percentage of protease, which breaks down matter containing nitrogen, i. e., protein.

I don't know the nature of the substance that was in this fabric, but it is quite possible that the proteases of the malt, which are not only active in ordinary malt but are concentrated in the Diastafor, may have been effective in doing that.

Mr. Herrmann—Do you happen to know whether the use of malt for such work is at all common? It was the first time I had ever encountered it, and it seemed to me to open up so many possibilities that I was wondering whether this particular gentleman had just happened upon something that may be very valuable to other people.

Dr. Lee—Personally, I don't know whether it is generally used in the textile industry or not.

Mr. Fiske—It is generally used in the textile industry in connection with starch.

Dr. Lee—Do you know whether it is used for this other purpose?

Mr. Fiske—Not as far as I know.

Dr. Lee—He probably stumbled onto that. He probably knew that Diastafor was good for desizing, and he knew this was something like that, and perhaps some "wise fool" thought it would work, tried it, and it did work.

Mr. Fiske—Did he get the results he was looking for?

Mr. Herrmann—He did, and our conclusion was the same as Dr. Lee's.

P. J. Wood—Mr. Chairman, some years ago Dr. Knecht drew attention to the fact that the enzymes of saliva had an effect on cotton, not only on cotton which contains sizing, but on cotton *per se*. He concluded that there was some action that changed the cotton itself, because he found that cotton subjected to the action of saliva took a deeper shade than cotton not treated in that way. In fact, he treated it locally and found quite a distinct difference in the action of coloring matter on cotton.

I have been very much interested in Dr. Lee's talk. I must confess ignorance on the subject. Up to this evening I had thought that enzymes were organisms. I don't know where I got that idea. I suppose I just thought it. But it seemed to me that the action of enzymes was very much like that of some other organisms, and I had always considered the brewing directly due to the yeast. I cannot see, if they are not living organisms of some sort, how they can have this action other than the catalytic action which Dr. Lee has explained. It seems quite remarkable to me that they can act in such very dilute concentration, so to speak.

I am going to display my ignorance a little bit further and ask if there is any relation between vitamins and enzymes.

Dr. Lee—We have not progressed quite far enough with the vitamins to know whether they belong to the class of enzymes, or not. It is quite possible that they do. Very extensive work is being carried out on all of the vitamins (Vitamins A, B and C) and, as you know, Dr. Eddy, of Columbia University, has recently isolated a near vitamin which he calls Alpha Bios (and will shortly publish a report on his discovery of the Beta Bios) which is a very powerful—I don't know whether to call it "enzyme," "catalyst," or "vitamin."

This work in which the Bios was discovered was done in connection with a search for the origin and nature of Vitamin B. The men who are working on it are getting closer to it every day, and I think we will find that the vitamins are among the most powerful of the agents which have to do with life processes and quite possibly that they are in some way related to enzymes.

Chairman Hayes—Are there any further questions?

Mr. Hirst—Doctor, I understand you to say that the enzymes of the malt are most efficient at 150 deg. Fahr. Is that true in a practical way, that is, when it is used for destarching purposes in the textile mill?

Dr. Lee—One hundred forty to one hundred fifty. There is a greater range of temperature than there is a range of acidity.

Mr. Hirst—And they aren't destroyed until they get close to 170; is that correct?

Dr. Lee—Destruction begins, I suppose, at around 155 or 160. It can be detected. And at 170, they are pretty well shot.

Mr. Hirst—If you keep below 155, are you safe?

Dr. Lee—Absolutely.

Mr. Hirst—There is a product known as Rapidase which you have no doubt come into competition with recently. That is not grown malt, is it?

Dr. Lee—I don't know exactly where the Rapidase comes from. There are a number of amylases, and many of them come from the plant kingdom from molds, and a number of molds possess very strong amylases. I am, personally, most intimately acquainted with the enzymes of yeast and am not familiar with the commercial products, commercial amylases, so I don't know from what it is derived.

Chairman Hayes—You spoke, Doctor, of the maximum efficiency being at a concentration of pH-5. I believe that is what you said. Can you tell me, approximately, the percentage increase in efficiency over, say, neutral solution and one with a concentration of pH-5? In other words, in a plant, would it pay to try to keep a concentration of pH-5? We use it in neutral condition.

Dr. Lee—It would be well worth while to have it close to pH-5. Of course, if you have your hydrogen ion apparatus all set up and are using it constantly, that wouldn't be a very difficult proposition. On the other hand, if you are not, the use of Methyl Red as an indicator, the center of change of which is just about pH equals 5, I think would be perfectly satisfactory, within the range of the Methyl Red change, as near the middle of that range as you can make it. Methyl Red begins to change at about 4.2 and runs to about 5.8. So the center of the change is very close to the point of greatest activity of the Diastase.

Chairman Hayes—Have you any idea as to the percentage?

Dr. Lee—It is pretty low around 4, and it is pretty low above 6. It works, of course, clear up to the neutral point, but it will work much more rapidly and efficiently in a slightly acid solution. It is well worth while con-

trolling the acidity because I think the acidity is more narrow—I am sorry I didn't bring the curves on that.

Mr. Wood—Mr. Chairman, I should like to ask Dr. Lee if he has any acquaintance with any enzymes which could be used for degumming silk at a low temperature, because it would be very desirable to find some method other than boiling off with soap. For instance, in the case of silk combined with Celanese, which will not stand a strong alkaline bath, or a high temperature.

Dr. Lee—I don't know of any commercial product. There are products in the plant kingdom. Yeast itself has a dextrinase and a glycogenase which break up glycogen, and I am sure that some of the molds have enzymes that will attack gum. But I don't know of any commercial product. It would take a little research to develop such a thing. What is the nature of the gum?

Mr. Wood—The gum is not a vegetable product. It is animal. It is a ceresin.

Dr. Lee—What class does it belong to?

Mr. Wood—Protein.

Dr. Lee—Well, I should think that pepsin or trypsin would attack a product of that sort, and those are both commercial products.

Mr. Wood—There was a product introduced by Takamine of Japan, which I believe was made from rice, which they said had an effect on silk gum, and I believe it has been used a great deal in Japan. We have never been able to use it successfully here.

Dr. Lee—It would take a little experimenting to find out under just what conditions it would act best, and what raw materials to use. But it would be well worth trying some of the commercial proteases that are now on the market. There might be protease enough in Diastafor to do that; I don't know. I have never made the experiment.

Mr. Wood—I don't like to be doing all the talking, but these questions occur to me, and I don't think of them all at one time.

What relation do the enzymes bear to the bacteria which produce them in cases in which bacteria do produce them?

Dr. Lee—If I understand your question correctly, most of the enzymes are intracellular. They are produced by the bacteria or by the yeast, and remain within the organism. In some cases, however, they come out from the yeast and can act on the outside—yeast, or bacteria, of course.

The enzyme, zymase, for example, is intracellular. It remains within the cell. The sugar has to go into the cell by osmosis and be acted on there by the zymase.

In the case of invertase, however, that is easily leached out of the cell in pure water solutions, and if a small quantity of yeast is put into a solution of cane sugar, long before the sugar is fermented all of it will be inverted by the enzyme which has come out of the cell and acted upon it.

Mr. Wood—In the case, for instance, of intestinal flora, are there any enzymes produced by such flora?

Dr. Lee—I think they are all intracellular. They are not set free, although that does not mean that the bacteria cannot break down the soluble material which they cannot take in. They adsorb that, break it down, and discharge it.

Chairman Hayes—We are waiting for more questions.

One of the most interesting points, to me, that Dr. Lee brought out was the fact that each enzyme has a specific function to perform, because in the last ten or fifteen years every malt salesman I have seen has told me that his particular malt compound would take on more starch, give better penetration, necessitate the use of less dyestuffs, give brighter colors, and do about everything else. Therefore, I am glad to have an answer for them from such an authority as Dr. Lee. I even remember one malt salesman claiming that if I used his malt, I would get out more starch and have heavier goods. I couldn't quite see it. (Laughter.) We are all deeply indebted to the three speakers of the evening. We have had three very good and very interesting addresses. I am going to call for a rising vote of thanks.

. . . A rising vote of thanks was extended to Messrs. Marsson, Fiske and Lee. . . . (Applause.)

. . . The meeting adjourned at ten-five o'clock.

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AMERICAN
DYESTUFF REPORTER

Devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto.

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FAST COLOR EDUCATION CONTINUES

COLOR, by itself, no longer sells the goods. The old charm of shade and design still attracts the shopper, but in the majority of sales made over the counter to-day this quality alone does not clinch the sale. The purchaser is learning to regard color as something *in* the goods, not on the goods, and as something meant to remain in the goods. For this reason mills that are alert to the situation emphasize the fastness of their colored goods.

Appearing in the Daily News Record and other apparel trade papers, a current advertisement of Col-Tex Fabrics carries in bold type the headline: "You Can't Drive the Aniline Fast Black Out of Col-Tex Suitings!" A paragraph in one corner of this advertisement mentions the company's boss dyer by name and credits him with thirty-three years' experience. It is a very convincing sales argument, this featuring of the color fastness and the dyeing of the goods above other properties, and quite in line with modern buying habits.

Such advertising is a concrete illustration of color fastness linked to a trade-mark. It is but another sign that an educational campaign is now fully under way throughout the textile industry, with its purpose to teach the consumer and the trade that fast colors are well worth every cent of their slightly higher cost. The current advertising of the Du Pont Company in these pages is planned on the same theme, to assist in spreading fast color education among mills that are not yet convinced that the public demand is more than a passing fad.

This agitation for faster goods, moreover, has not been started by a few enterprising manufacturers. The public —the shoppers themselves—have been heard from on the question. The Du Pont advertising contains reference to an article on fast fabrics which lately appeared in Good Housekeeping, from which we learn that 84 per cent of the readers of that magazine ask for guaranteed fast colors when buying apparel or dress material.

Trade-marked fast-color fabrics will ultimately form the larger proportion of textile goods. They will ultimately push into obscurity the inferior grades of merchandise. The movement for more and better washable fabrics is shaking out old buying and selling methods all along the line, from dye manufacturer and textile mill down to the final judge, the consumer. Not merely the texture of the goods and its wearing qualities, nor the mere beauty of its shade are being emphasized. It is now understood by those who buy that all these factors are relatively unimportant if the dye in the goods will wash out or fade. Color in textiles is now regarded, not simply as something added for beauty, something that will vanish in the first laundering, but as a permanent quality.

THE STRENGTH OF SENTIMENT

TWO years ago the British Dyestuffs Corporation stirred up considerable hue and cry in Europe and the United States when it seriously entertained an offer from the German dye cartel to exchange technical information for certain marketing rights. It was asserted then, by both those defending and those opposing such an alliance, that the B. D. C. had been led to consider the German offer as a ready remedy for its somewhat anemic financial and technical condition.

Events since, however, have seemed to prove that England did not intend to let its dyestuff industry slowly expire for want of technical brains and capital or become absorbed out of all identity by foreign interests. The recent fusion of the six largest British chemical manufacturers, while somewhat lessening the individual prestige of the B. D. C., one of its main units, nevertheless insures for all time a strongly financed coal tar chemical industry, powerful because unified.

But the principle of a thoroughly co-operative industry was long preached by the British before they finally put it into practice. The January number of the Journal of the Society of Dyers and Colourists contains an interesting address made before the West Riding Section of the Society by W. J. Woolcock. It is a survey of the year's activities in the organic chemical industries of Great Britain and other countries, and is entitled "The International Dyestuffs Situation." In closing, the speaker said in part:

> From the evidence put forward in this address certain conclusions may be drawn. In the first place, in the present state of the world, in no country can the chemical industry of that country possibly succeed until it is welded together in one united whole. This is foreign to our English national temperment and will be opposed by the users of the products of that industry. Nevertheless the chemical industry is one and indivisible, and a very much closer working together of individual firms will in the end be advantageous to the consumer. . . . We are all anxious to see our own industry flourish and consider-

able sacrifices have been made to bring this about. It remains with us to see that the effort of the past eight years shall not be wasted.

The rather remarkable thing about this paragraph is that it was spoken only a few days before the announcement of the big chemical merger. Seldom does fulfillment so quickly follow upon the heels of prophecy. Thus the sentiment of the British chemical makers toward unification—a sentiment that had slowly but steadily gained force during the past three years—finally brought about that which had once appeared virtually impossible: It placed the principal unit of the country's dye industry upon a secure and profitable basis without direct resort to foreign assistance.

SPRING OPTIMISM IN TEXTILES

Prices of raw wool firmed up after a slight decline in the latter part of last year. Woolen mills are well employed. Their product is finding ready sale among consumers as a result of low costs and attractive styles of clothing.

The prices of raw silk and of rayon are the lowest in several years, and consequently their finished fabrics should find a ready market. The textile industry, as a whole, has a far better outlook for steady business, at stable prices, in the near future than for a long number of years.

The coming of spring always brings a substantial increase in the volume of business, with the widespread revival of outdoor activities and the awakening of need for seasonal goods of many kinds. This year, as usual, careful preparations have been made to meet this great revival of demand. The sentiment of those who look ahead is generally cheerful. Nothing more serious is looked for than the customary spells of unfavorable weather.

There is general agreement as to the inherent soundness of the present business situation.—From the Business Bulletin of the La Salle Extension University.

FURTHER COLOR STANDARDIZATION WORK PROVIDED FOR

Ten thousand dollars has been set aside by the Department of Commerce for color standardization work by the Bureau of Standards during the year 1927-1928. The original bill, as reported from the House appropriation committee, provided for $8,000 "to develop color standards and methods of manufacture and of color measurement, with special reference to their industrial use in specifications of colorants such as dyestuffs, inks and pigments, paper, paints and textiles, and other products in which color is a pertinent property." Representative Oliver of Alabama was able to put through an amendment calling for an increase to $10,000.

GERMANY NOW AN IMPORTANT FACTOR IN WORLD'S NITROGEN TRADE

Complete emancipation from dependence upon Chile as a source of nitrogen has been effected by Germany, according to a review of the German chemical industry, made public by the Department of Commerce. The development of new and improved finished fertilizers, embodying two or even three of the essential fertilizer ingredients, was one of the outstanding achievements of German chemical history in 1926. Germany, it is revealed, is now becoming an increasingly important factor in international trade in atmospheric nitrogen.

Last year saw many developments of real significance in the chemical industry of Germany, the report discloses. Its activities encompassed the field of pure and applied chemistry, involving technique and processes from the earliest treatment of the raw material to the final delivery of the most highly finished goods.

Of particular interest to the world at large, and especially to the United States, it is pointed out, is the rapid growth of politico-economic features involving the entire chemical industry. The progress of the dye trust, now the largest and most powerful commercial entity in the country, typifies Germany's industrial recovery. Its program of domestic and international expansion and concentration of production brought about a 240 per cent rise in the price of its stock which was one of the sensations of the year in German financial circles. After merging other industrial enterprises it raised its foundation capital to 1,100,000,000, thereby wresting first place in the German industrial world from the newly founded United Steel Works.

Marked progress, the report reveals, was made in experimental work on the problem of gas synthesis. The purpose in view is to enable Germany to ultimately undertake a domestic production of liquid fuels.

In the potash industry production has been concentrated on a minimum number of shafts. In November last, out of a potential 224 shafts, only 63 were operating. The potash industry is burdened by a heavy indebtedness of some half a billion marks which requires an annual interest payment of about 35,000,000 marks.

A five-million-dollar plant employing from 800 to 1,000 workmen will be erected at Hopewell, Va., by the Allied Chemical & Dye Corporation. The land has but lately been purchased from the Tubize Artificial Silk Company and other landholders, and improvement operations will be started in the near future.

Performance of Franklin Process Machine for Raw Stock Dyeing*

TWO years ago the Warren Woolen Company installed in its new dyehouse five open dye tubs, 4 feet 2 inches deep and 7 feet 3 inches in diameter, for raw stock dyeing. Six months later a 500-pound Franklin Process closed kier machine was purchased and its performance was such that within another six months a second machine of 250-pound capacity was installed to handle the smaller batches. So far, two of the old dye tubs have been removed.

In this department only wool for fine yarns is dyed, for men's high grade suitings and overcoatings. Chrome bottom, chrome top, chromate and some acid colors are used.

The Franklin Process machine consists of a large tightly covered cylindrical wood kier, a false bottom attached to a hollow center post on which the stock is piled, a tight fitting cover with an extension for compressing the loose stock to a level below the dye liquor inlet, an auxiliary tank for storage of liquor, a filter, and a motor-driven centrifugal pump to force dye liquor through the main kier.

Both machines are set below floor level so that the tops of the kiers are only 26 inches above the floor. This facilitates loading and unloading. Pumps also are located below the floor. Steam, for heating only, at 100-pound pressure, is supplied to the Franklin machines, and exhaust steam at 10-pound pressure to the open tubs.

Operation

Wool is put into the main kier wet or dry. If dry, water is pumped through to pack the stock down. When the kier is filled to the top a screen is placed over the stock, the cover is applied and the pump started. Dye liquor is pumped through the wool from the top down and from the perforated center post outward. Liquor flows always in one direction and there is no poling.

When finished the load is lifted out in a solid mass by means of a chain hoist hooked to the center post and false bottom.

The smaller machine has a ¾-ton hoist for lifting off the cover of the main kier and a 1½-ton hoist for lifting out the load. The 500-pound machine has a 1-ton and a 2-ton hoist. In each case the hoists are mechanically connected and are hung from a trolley above the main kier. When the load is lifted out it is set on the floor in front of the machine, torn apart, thrown into a box truck and dumped into an extractor.

One man tends both Franklin machines except that when a load is to be taken out he has the help of one man for twenty minutes. For the three open tubs, however, three men are required for loading, poling and unloading.

Once the Franklin kier has been brought up to temperature, little steam is required to keep it at 200 deg. Fahr., and none escapes to the atmosphere. In the open tubs steam is used constantly during the dyeing process and generally much escapes. Besides increasing the steam cost to some extent, this escaped steam makes room conditions unpleasant for the workmen and deteriorates the building, necessitating more frequent painting of walls, ceilings and machinery.

Output and Comparative Costs

Both machines are operated eight and three-quarter hours a day, forty-eight hours a week, and 260 days a year. The smaller unit handles batches of 75 to 300 pounds, averaging 250 pounds, and the larger commonly handles batches of 250 to 650 pounds, averaging 500 pounds. Two batches are ordinarily run per day, but three are often put through with light colors. The maximum day's run was 2,300 pounds with both machines in use on acid colors. The output of the open tubs is ordinarily two batches a day of 350 pounds each, per tub.

Cost of dyeing with the Franklin Process machines is $0.0095 per pound for the 250-pound machine and $0.0060 for the large unit. These figures do not include the cost of dye, which is the same per pound of stock as for the open tubs. It does include fixed charges on the equipment, steam, labor and power for operating the pumps. These costs are detailed in Table A.

The cost with the open tubs is $0.0100 per pound when dyeing 350-pound batches, and $0.0130 on 250-pound batches. The fixed expenses on the open tubs are much less than for the Franklin Process machines and no power

Installation of Franklin Process Machines, Showing Unloading Operation

*Survey made by A. C. Nielsen Company, Engineers, in collaboration with and approved by A. B. Shepherd, overseer of dyeing, Warren Woolen Company, Stafford Springs, Conn.

is required, but labor and steam costs are higher. These costs are detailed in Table B.

Savings effected by the Franklin Process machines are shown in the comparison of costs in Table C, figured for 250-pound batches run by both methods, and for 350-pound batches run in the open tubs and 500-pound batches run in the large machine. The small Franklin machine effects a saving of 27 per cent, or $0.0035 per pound, and the large machine reduces the cost 40 per cent, or $0.0040 per pound.

TABLE A

Cost of Dyeing with Franklin Process Raw Stock Machines

	Machine 250-Lb.	Machine 500-Lb.
Investment (first cost plus installation)	$2,000.00	$2,800.00
Fixed charges:		
Depreciation at 10 per cent	$200.00	$280.00
*Average interest at 6 per cent	66.00	92.40
Allowance for maintenance and repairs	100.00	140.00
Total fixed charges	$366.00	$512.40
Daily operating costs:		
Daily fixed charge (260 days)	$1.41	$1.97
Steam—1,690 pounds at 70 cents per 1,000	....	1.18
1,025 pounds at 70 cents per 1,000	.72	....
Hoist —Included in investment	....	....
Power—(5 h.p.) 19 kw.-hr. at 2 cents	....	.38
(3 h.p.) 11 kw.-hr. at 2 cents	.22	....
Labor—8¼ hr. at 48 cents (1 man for both)	2.10	2.10
Unloading—2/3 hr. at 48 cents	.32	.32
Total daily operating cost, excluding dye	$4.77	$5.95
Production (average pounds per day)	500	1,000
Unit costs (per pound)	$0.0095	$0.0060

*Allowing for interest earned by depreciation reserve.

The annual savings are $455 for the small machine, a net annual return of 22.8 per cent on the investment, and $1,040 for the large machine, a net return of 37.2 per cent.

Other Features

Dyeing is carried on at 200 deg. Fahr. in the Franklin Process and at boiling in the open tubs. The lower temperature tends to turn out better stock. There is no poling, and thus no matting or felting. Waste is lower, but has not been accurately determined.

The Franklin machines require less floor space than open tubs as shown by the following figures:

	Franklin 250-Lb.	Franklin 500-Lb.	Open Tubs
Space required (square feet)	128	161	210
Square feet per 1,000 pounds per day	256	161	300

TABLE B

Cost of Dyeing in Open Tubs

	Batch 250-Lb.	Batch 500-Lb.
Fixed charges on three open tubs:		
Depreciation—$2,100 divided by 10-year life	$210.00	....
*Average interest at 6 per cent	69.30	....
Allowance for maintenance and repairs	200.00	....
Total fixed charges	$479.30	(Same)
Daily operating costs:		
Daily fixed charge—$479.30 divided by 260 days	$1.84	$1.84
†Steam—1,720 pounds per batch (six batches at 70 cents)	....	7.22
20 per cent less for small batch	5.77	....
Labor—Three men (8¾ hours each at 48 cents) $12.60		
Less 1 1/3 hours on Franklins .64	11.96	11.96
Power—None	....	....
Total daily operating cost, excluding dye	$19.57	$21.02
Production—Lb. (two batches per tub per day)	1,500	2,100
Unit costs (per pound)	$0.0130	$0.0100

*Allowing for interest earned by depreciation reserve.
†Steam measured for 350-pound batch.

TABLE C

Comparison of Raw Stock Dyeing: Open Tub vs. Franklin Machines

Data—	Small Batch 250-Lb. Tub	Small Batch 250-Lb. F'klin	Large Batch 350-Lb. Tub	Large Batch 500-Lb. F'klin
Steam—Lb. per lb. wool	5.50	2.05	4.91	1.69
Sq. ft. floor per lb. wool	.42	.26	.30	.16
Costs per lb. wool—				
Fixed costs	$0.0012	$0.0028	$0.0009	$0.0020
Steam	0.0038	0.0014	0.0034	0.0012
Labor	0.0080	0.0049	0.0057	0.0024
Power	....	0.0004	....	0.0004
Total	$0.0130	$0.0095	$0.0100	$0.0060

Savings Effected by Franklin Process

	250-Lb. Franklin	500-Lb. Franklin
Per pound	$0.0035	$0.0040
Per cent reduction	27.00	40.00
Net return on investment (per cent)	22.80	37.20
Annual saving	$455.00	$1,040.00

THE FRENCH SULPHURIC ACID INDUSTRY

France possesses eighty-seven sulphuric acid plants, and, in point of importance, occupies fourth place in the world's production after the United States, Germany and England. Sulphur is imported in the form of brimstone, sulphur ore and pyrites. There is also a local production of pyrites from the Saint Bel deposits on the Rhone. Spanish pyrites are brought to France in a fleet of vessels engaged solely in the trade; the supply from this sourse is, therefore, quite regular.

RECENT LITERATURE

Carbon Arc Measurements

Radiometric Measurements on the Carbon Arc and Other Light Sources Used in Phototherapy. By W. W. Coblentz, M. J. Dorcas, and C. W. Hughes. Scientific Papers of the Bureau of Standards No. 539. Illustrated. Price 15 cents.

In this paper data are given on the distribution of energy in the spectrum of the carbon arc under various conditions of operation. The problem was attacked by two methods: (1) The energy distribution in the visible and in the ultra-violet spectrum of the radiation emitted from the central line through the arc and incandescent electrodes was obtained by means of a quartz spectro-radiometer, and (2) by means of transmission screens the spectral radiation components of the whole arc, including the surrounding reflector, if present, were obtained in seven steps throughout the complete spectrum.

Data are presented on the variation in the radiation from the carbon arc, using different sizes and kinds of carbon electrodes, different kinds of cores, and the effect of a.c. and d.c.

Comparative data are given on the sun, the gas-filled tungsten lamp, the quartz mercury arc, and the arc between metal rods of tungsten and of nickel. The results obtained show that while the carbon arc approaches nearest the sun in spectral energy distribution it is important to see the proper size of electrode and current in order to obtain the most efficient operation of the lamp.

The high intensity arc was studied, and while it was found useful for large installations the same relative proportions of ultra-violet to the total emitted can be obtained from a small unit utilizing 20 to 30 amperes as is obtained from the larger unit taking 90 to 125 amperes.

Economics of the Chemical Plant

Chemical Engineering Economics. By Chaplin Tyler. 271 pages. Illustrated. $3.50. McGraw-Hill Book Company, Inc.

A practical discussion of economic and business principles as they apply to the chemical engineering industry. The book develops systematically the important economic considerations in the practice of chemical engineering and of applied chemistry. The subject matter has been selected and developed with particular reference to advanced students of chemical engineering and recent graduates of such courses, in order to bridge the abrupt gap that usually separates classroom instruction from practice in the industrial plant. Parts of the book were planned for the many non-technical executives that hold responsible positions in the chemical engineering industries, in the belief that such executives need at least an appreciation of chemical engineering and its applications.

The first two chapters are intended to lend background to the subject, being an outline of the characteristics, scope and magnitude of the chemical engineering industries. Subsequent chapters follow in definite order, beginning with a study of the commercial feasibility of chemical engineering projects, and then considering such factors as plant location, design, cost accounting, unit operation costs, and finally the practical economics of management, power utilization and operation.

The author is assistant editor of Chemical and Metallugical Engineering.

Raw Silk Classification

Second Report of the Raw Silk Classification Committee. 52 pages. Illustrated. Silk Association of America.

Tests for raw silk qualities and the grading of raw silk are given to the silk industry in the publication of this second report of the Raw Silk Classification Committee by the Silk Association of America.

The standards set forth in this important publication are intended, according to the foreword, to facilitate transactions between buyer and seller; but apply to transactions governed by the Raw Silk Rules of the association, only when so specified in the sales contract.

A large amount of experimentation by co-operating laboratories, and thousands of tests covering the entire range of quality of raw silk available on the New York market have preceded the submitting of the report. The results are instructively presented.

The contents of the book include the definition of defects, major and minor; methods of testing according to the classification; and other tests still in a state of development; a table classifying silk according to seven grades; the classification of a lot of raw silk, and appendices furnishing an interpretation of tests not yet developed. Forty-three very interesting illustrations accompany the text.

Stains

Stain Removal from Fabrics—Home Methods. United States Department of Agriculture. Farmers' Bulletin No. 1474. 30 pages. Illustrated. 5 cents.

This booklet is chiefly interesting for the very thorough manner in which the process of removing all kinds of stains from various fabrics is treated. Agents such as

alcohol, acetic acid, benzol, hydrosulphite, peroxide and other easily obtainable chemicals are recommended, depending, of course, on the nature of the stain.

Standard Specifications

United States Government Master Specifications for Soap, Cake, Grit; for Denim, Indigo Blue (Shrunk); for Towels, Huck (with woven name); for Soda Ash. Circulars of the Bureau of Standards. Department of Commerce.

New specifications on four textile and chemical materials evolved by the Bureau of Standards. The Government's general and detailed requirements and methods of testing each of these products is given in compact form and should be most interesting to both users and manufacturers of the materials specified.

Tariff Commission Report

Tenth Annual Report of the United States Tariff Commission. 1926. 145 pages.

The first section contains information about the functions, organization and activities of the Tariff Commission. The remainder of the book is a detailed record of tariff proceedings under various sections and schedules of the Fordney-McCumber Tariff and of the work of the various divisions of the Commission, with considerable data on the surveys, reports and investigations completed during the year. The Dye Census Report is briefly summarized and a mass of statistics given on other industries.

Resins—Natural and Synthetic

The Chemistry of the Natural and Synthetic Resins. By T. Hedley Barry, Alan A. Drummond and R. S. Morrell. 196 pages. $5.00. Oil and Color Chemistry Monographs. D. Van Nostrand Company.

The intricate chemistry of the natural resins is dealt with as briefly as possible, to show the need for fundamental research, because until more is known of their composition the causes of the formation will continue to remain obscure. The natural resins described are those used in varnishes.

Of the synthetic products, up-to-date information is provided, recent practice summarized and the fundamental principles of resinification discussed as far as the present limited knowledge permits.

Casein and Methanol Tariffs

Casein. Report of the U. S. Tariff Commission. 28 pages.
Methanol. Report of the U. S. Tariff Commission. 30 pages. 10 cents.

These reports cover data on the differences in cost of production of both products in the United States and in the principle competing countries.

The methanol report consists of exhaustive data on the description of uses of methanol, its raw materials, joint products, by-products and competitive products; on the domestic industry, its production, consumption and marketing of methanol here and abroad, with comparative data on production of the German product.

IMPERIAL ASPECT OF THE NEW BRITISH CHEMICAL COMBINE

Imperial aspect of the new British chemical combine is discussed in a prospectus of the company, submitted by Trade Commissioner Homer S. Fox, London. It states:

"The company has, of deliberate purpose, been given the title of Imperial Chemical Industries, Ltd. The British Empire is the greatest single economic unit in the world, one in which every patriotic member of the great British Commonwealth has a personal interest. By linking the title of the new company to that unit, it is intended to lay emphasis upon the fact that the promotion of imperial trading interests will command the special consideration and thought of those who will be responsible for directing this new company. The participating companies already enjoy a world-wide trade; their merchanting and manufacturing operations extend throughout the British Dominions overseas; and it will be the avowed intention of the new company, without limiting their activities in foreign overseas markets, specially to extend the development and importance of the chemical industry throughout the Empire."

FOREIGN DYES APPRAISED

(*Continued from page* 118)

Trisulfon Brown 2G Conc	C
Rosinduline 2B Bluish	NC
Vat Violet RR Extra Double Paste	C

OCTOBER

Alizarine Light Blue B	C
Alizarine Light Blue B Conc	C
Alizarine Sapphire Blue SE 72%	C
Brilliant Sulphon Red B	C
Chloramine Red 3B	C
Cibanone Golden Orange G Powder	NC
Cibanone Red 4B Powder	NC
Indanthrene Blue GCDN Powder	C
Methylene Green G Extra Conc	C
Neolan Blue GG 52%	NC
Neolan Orange R 72%	NC
Neolan Pink G 38%	NC
Pyrazol Orange G Conc	C
6 Soloid M/S Pomanowsky Stain 0.015 Gram	NC
Trisulfon Brown 2G Conc	C
Xylene Blue VS Conc	C

NOVEMBER

Alizarine Sapphire Blue SE	C
Chloramine Red 3B	C
Gentian Violet Pure	NC
Methyl Violet Pure	NC
Methylene Green G Extra Conc	C
Rhodamine P Extra	C
Romanowsky Stain	NC
Safranine	NC
Thional Brilliant Green GG Conc	C

Technical Notes from Foreign Sources

Uneven Dyeings of Cotton

There appears to be any number of ways in which a textile fiber can be dyed in uneven shades, and the question often arises whether or not the dyer has sufficient information on all the various factors that influence the dyeing process. Furthermore, there are causes of unequal dyeing which are entirely outside of the control of the dyer. Thus some exist in the fiber as it grows and others are added as the fiber is being processed and converted into a form suitable for dyeing. Hence, these are not under the control of the dyer.

If a piece of cotton cloth is made from cotton of variant origin, then in this fact alone is there to be found a cause of uneven dyeing. In the same manner causes of uneven dyeing are found in the practice of making improper mixing of cotton fiber in the spinning process. Hence, when different cottons of dissimilar origin, containing different proportions of wax, are woven together and then bleached, different shades will be observed in the cloth after dyeing. Investigations were made in the effort to locate the seat of the trouble in the boiling out kettle, but these were not successful.

Cotton of different origin was bleached and dyed in the same bath with direct, sulphur and vat dyestuffs. The cottons were then compared with one another and it was found that the Sea Island cotton was dyed the lightest of all, then followed West Indian, Egyptian, "Uppers," Texas, American, "Broach," Indian Domra and Indian cotton, the latter being deepest colored of all.

It is believed that the difference in the intensity of the dyeing is due not to differences between the chemical composition of the cottons, for the same gradation in color difference was observed with each of the cottons in the series. The conclusion was hence reached that the variation in the depth of the dyeing is due not only to the structure of the product and the yarn prepared from it, but also on the structural difference in the cotton fiber of various types of cotton, such as the thickness of the walls of the fiber. This explains the fact that dead cotton which has only a thin walled fiber is dyed in lightest shades. However, it is not believed that the thickness of the walls is the sole structural difference between these cottons which has an effect on the depth of the dyeing. Tests made with yarns of Egyptian and Indian cotton indicated the truth of this contention. It may be concluded from this study that while an essential condition in the spinning of cotton is that the various cotton stocks used together all are of the same staple length, nevertheless, in the dyeing of cotton yarns and fabrics made from these various cottons it is also necessary to select cottons of the same *average thickness* of fiber wall in spinning the yarn or weaving the fabric in order to obtain uniformly dyed produces. (Deutsche Faerber Zeitung, 1926, page 759.)

Gel Structure of the Wool Fiber

It is shown in this paper that the wool fiber has a true yield point and, after extension, remains permanently more extensible than under low loads. Such observations are held to necessitate the replacement of the theory that wool has a two-phase gel structure by a four-phase theory. It is argued that the wool fiber consists of two gels arranged in parallel.

The first gel may be called the petrified gel, and comprises an elastic cell wall enclosing a fibrillar structure which is not in physical equilibrium with a viscous phase. The second, which fills the interstices of the petrified gel, is gelatinous and capable of reversible solution in, and deposition from, water. Gelation occurs at a temperature of 0 deg. Cent. in water, and at ordinary temperatures in unsaturated air, and under such conditions the medium possesses the usual two-phase structure of gels.

The wool fiber, therefore, actually consists of four phases, but for convenience these may be reduced to three, as follows: First, an elastic cell wall enclosing; second, a fibrillar structure which is not in physical equilibrium with; third, a viscous, gelatinous medium included in its interstices. The experiments described deal with breaking loads, elongation at break, and breaking stresses, and include measurements of the effect on these factors of diazotization, formaldehyde, benzoquinone, boiling water and chlorine water. (Journal of the Textile Institute, 1926, Vol. 17, pages 457-471T.)

Carbonizing and Boiling-Off Shoddy

The well-washed wool is well impregnated with a cold solution of sulphuric acid of 3 to 5 deg. Be. concentration in wooden, stoneware or the like vats, and it is then centrifuged in centrifuges which are provided with a lead lining or an acid-resistant enamel coating and dried in the so-called carbonizing furnace at a temperature of approximately 80 to 90 deg. Cent. After drying, the wool is washed in a solution of sodium carbonate of 2 to 5 deg. Be. concentration, and thereafter it is well washed with water. The latter treatment is of particular importance in the dyeing of the goods in subsequent processes, for the acid that remains in the wool in comparatively large amounts causes the dyestuffs to be absorbed by the fiber at too great a rate, which causes irregular dyeings. The carbonization may also be effected with the aid of gaseous hydrochloric acid. Rotating drums are used for this purpose. If the vegetable ingredients of the wool are completely destroyed by the acid treatment, then the carbonized residue is removed in a suitable apparatus and the material is neutralized, as above, with the aid of sodium carbonate.

The boiling-off treatment or stripping has the purpose

of removing fugitive colors from the fibers and to avoid a dark ground so far as possible, so that it is possible to dye the shoddy in as light shades as possible. This stripping is also necessary when the wool is to be dyed in colors that are fast to fulling. When the ground color of the wool is not fast, then cross-dyeing with dyestuffs that are fast to fulling gives a product which is unsatisfactory.

Various methods may be used for removing the ground color of the woolen rags. Stripping with the aid of sodium carbonate is principally suited for treating women's dress goods, tricots and the like, which are mostly dyed with acid dyestuffs. Every shoddy must be subjected to this treatment in order to prevent the dye from bleeding during the fulling operation.

The rags are placed in a sodium carbonate liquor, 10 per cent concentration, at temperature of 40 to 50 deg. Cent. They are treated for one-half to one hour in this liquor, washed well with water, and then dyed. In the case of very dark material the stripping is repeated. Dark colored material, in which the stripping with soda gives unsatisfactory results, is treated with sulphuric acid or with potassium chromate and sulphuric acid. The stripping with sulphuric acid is preferred for materials which are principally dyed with wood dyes.

The material is boiled with 10 per cent or more sulphuric acid, then washed with cold water, or dyed, without washing, in a fresh liquor, if the dyestuffs that are used can stand up against very strongly acid dyeing.

Stripping with potassium chromate and sulphuric acid is frequently used, for a large number of artificial and natural dyestuffs are thereby completely or partly destroyed due to oxidation, or they are so fixed that bleeding in the fulling treatment is avoided. The shoddy is simultaneously mordanted with potassium chromate, so that it can be dyed with alizarine or mordant dyestuffs.

In certain cases the stripping process with potassium chromate and sulphuric acid can be carried out simultaneously with dyeing, and to make this possible, it is necessary to use regular dyeing dyestuffs which are fast to chromium salts and which are used in string acid liquors. In accordance with the character of the ground color the boiling is carried out for three-quarters of an hour with 3 to 6 per cent of potassium chromate and 6 to 12 per cent of sulphuric acid, and the action of the stripping agents is enhanced by the addition of 3 to 6 per cent of oxalic acid.

Hydrosulphite has a very powerful action in stripping. Approximately 2 per cent of Monopole soap is added to the stripping bath for brightening the shoddy.

Certain dyestuffs are not sufficiently stripped from the shoddy by the treatments which have been described above and a certain amount of the color remains on the fibers, which will bleed when the wool is fulled. In such cases it is advisable first to carry out the stripping with hydrosulphite and then to wash the material and finally to give it an aftertreatment with a lukewarm soda liquor. (Deutsche Faerber Zeitung, 1926, pages 1231-1233.)

Dyeing Apparatus

Yarns on cops are dyed in part only by liquid applied to one part and drawn through the yarn by suction applied to another part. The apparatus that is used for this purpose and that is patented in British Patent No. 259,793 is shown in the accompanying illustration.

FIG.4.

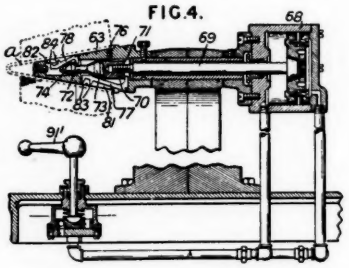
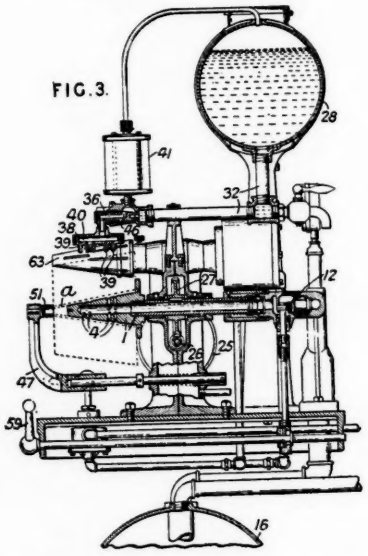


FIG.3.



A perforated tube *a*, wound with yarn, is mounted on a hollow mandrel 1 and held in place by a spring pressed hollow 51 carried by an arm 47. Orifices 4 communicate with the interior of the mandrel, which may be connected to a vacuum tank by the opening of a valve 12 under the control of the handle 59. Liquid flows from a tank 28 through pipes 32 and a valve 36 into a supplementary reservoir 41. A distributing head 38 with nozzles 39 serves as the handle of the valve 36, and when the head is depressed to bring the nozzles into proximity with the yarn the valve is turned to permit the liquid to run through passages 46, 40 to the nozzles, and the liquid is drawn through the yarn by suction from a vacuum tank 16. The mandrel 1 is rotated by gears 26, 27 driven by a motor 25, so that the cop is dyed in a series of parallel layers. The tubes *a* may be perforated after being wound

on the device shown in Fig. 4, this device being incorporated in the dyeing machine.

The tube is placed on a mandrel 63, inside which is a plunger 70 connected to a piston rod 69 driven by a piston 68, to which compressed air is supplied from a disk valve controlled by a handle 91'. On the forward stroke of the plunger conical surfaces 73, 74 bear against levers 77, 78, working in slots 81, 82 in the mandrel and provided with points 83, 84, which pierce the tube. The return of the plunger withdraws the points by engagement of the parts 71, 72 with the heels of the lever, thus allowing the cop to be removed. The plunger 70 is adjustably mounted on the rod 69, but is prevented from rotating by a key 76. Two mandrels 1 are provided on one machine and one perforating mandrel 63, so that while one cop is being dyed another is being perforated and placed on the other mandrel. Vacuum pumps and an air compressor are mounted on the machine and are driven electrically.

Ultra-Violet Light on Wool

Wool becomes more acid when exposed to the action of ultra-violet light and develops a yellowish color with quinone in place of the usual violet color. Bleached wool gives the same yellowish coloration. Tips of wool which have been exposed to sunlight always behave differently from wool situated nearer the skin. (Comptes rendues, 1926, volume 183, pages 596-598.)

Valuation of Artificial Silks

The numbers obtained by multiplying together the elasticity, expressed as a percentage, and the wet and dry tensile strengths, expressed in grams per denier, of rayon or natural silk yarns, are considered to be suitable for comparing their commercial values. For example, artificial silk yarn having 20 per cent elasticity, 2.0 and 0.65 grams tensile strength dry and wet respectively ($20 \times 2.0 \times 0.65 = 26$) is considered superior to artificial silk yarn having 25 per cent elasticity, 1.3 and 0.55 grams tensile strength dry and wet respectively ($25 \times 1.3 \times 0.55 = 17.67$). The method of valuation may be extended so as to include luster and purity of white color. (Chemiker Zeitung, 1926, volume 50, pages 643ff.)

CHARLES STONE NOW HAS OWN DYESTUFF BUSINESS

Charles H. Stone, of Charlotte, N. C., has established a dyestuff and chemical business with temporary offices in the Johnston Building. For the past twenty-two years Mr. Stone has been well known in the trade as technical demonstrator and salesman of dyes and textile chemicals. He expects shortly to move his new business office, warehouse and laboratory into one building as soon as he can secure a suitable location.

SPRING MEETING OF COMMITTEE D-13

In arranging the program of its regular spring meeting, the active Committee D-13 of the American Society for Testing Materials selected the Massachusetts Institute of Technology as an appropriate place for its members to gather. Moreover, its officers have extended a general invitation to any of the textile industry who may care to attend this meeting. The dates are March 11 and 12.

Several very interesting papers will be presented in addition to regular committee reports, which in themselves contain the results of this body's recent testing work. The buildings of the Institute will be open for inspection, and an excellent opportunity is thus offered to those who are interested to see what the Institute is doing in its textile laboratories.

DYE DIVISION PLANS PROGRAM FOR RICHMOND MEETING

Technical papers on textile subjects will probably form the major part of the program now being arranged by the Dye Division of the American Chemical Society for its meeting, April 12 and 13, at Richmond, Va., since this meeting will be near the heart of the South's textile industry.

DR. PIERCE NOW WITH CIBA

Dr. E. M. Pierce has become associated with the Ciba Company, Inc., New York, as technical demonstrator. Dr. Pierce, who until recently was connected with the Weidmann Silk Dyeing Company, of Paterson, has had many years of wide experience in the textile and dyestuff trades. In his new capacity he will offer a general technical service to mills.

NATIONAL ISSUES RAYON SHADE CARD

Under the title of "Dyes for Rayon," the National Aniline & Chemical Company has brought out what it describes as an important addition to the literature of dyeing rayon. This new shade card is exceptionally attractive in make-up and shows fifty-six dyeings on knitted goods. Supplementing this wide and interesting range of shades are full technical instructions for the application of the dyes shown, in which the series of National Solantine dyes are especially featured.

BACO BULLETIN

In starting its seventeenth year in the aniline dyestuff and lake color business, Bachmeier & Co., Inc., New York, have issued its Baco Dyes Bulletin in a slightly different dress. This leaflet lists the manufacturer's new colors for silk, rayon and hosiery, as well as new products for stripping and discharge printing.

WOOL BLACK ADDED TO NEWPORT RANGE

A black for the dyeing of wool felt and silk has lately been produced by the Newport Chemical Works, Inc., and is being marketed under the name Newport Wool Black GRF. This new color is described as exceptionally fast to light, with very good level dyeing and penetrating properties. It is particularly adapted for the dyeing of such closely woven materials as wool and fur felt, silk, etc. It is also recommended for both silk and wool printing. According to the description of this color, its fastness to steaming, acids, alkalies, perspiration and salt water is excellent, and it does not stain effect threads of cotton and rayon.

NEW RED PASTE IN PONSOL SERIES

The research laboratories of E. I. du Pont de Nemours & Co. have developed a new vat color which has been added to the Ponsol series under the name Ponsol Red AFF Double Paste. On cotton and silk this color produces shades of bright bluish red, which are described as possessing excellent fastness to practically every destructive agent to which materials of these fibers would be exposed. It is said to reduce easily and to be exceedingly level dyeing, and is therefore classed as one of the limited group of vat colors which can be added to the dye bath all at once before entering the yarn, and which do not require the addition of any retarding agent.

This new Ponsol Red Paste, according to the announcement, can be used in all types of machines and is not affected in shade by copper, iron or Monel metal. Some of its chief uses are for dyeing pink and rose shades on silk and rayon, as well as for full fast shades of bluish red. The color is used as a self shade as well as in combination for washable fabrics and can be applied equally well, it is further claimed, either as a pigment or from the reduced vat.

CELANESE HOSIERY BOOKLET

A very useful little booklet on the dyeing of Celanese hosiery has just been issued by the makers of Celanese, the American Cellulose & Chemical Manufacturing Company. It contains brief technical information on the dyeing of hosiery made wholly or in part of Celanese yarn, with complete dyeing recipes for twenty-four of the seasonal shades.

NORTH CAROLINA TEXTILE SCHOOL RECEIVES NEW EQUIPMENT

The Textile School of the North Carolina State College recently received the following donations: One new silk loom from the Stafford Company, Readville, Mass.; one Celanese warp for this loom from the American Cellulose & Chemical Company, New York; harness frames, heddles and reed from the Steel Heddle Manufacturing Company, Philadelphia, Pa.

At a meeting of the Textile Society, which consists of students in the Textile School, the following officers were elected to serve during the ensuing term: D. A. Purcell, president, Reidsville, N. C.; G. E. Kohn, vice-president, Mount Holly, N. C.; J. M. Dunn, secretary and treasurer, Charlotte, N. C., and F. E. Plummer, reporter, Selma, Ala.

F. W. Warrenton, class of '26, has been transferred from the Martel Mills, Asheville, N. C., to the Mercury Mills, Charlotte, N. C. E. C. Mitchener, class of '26, has been appointed assistant superintendent of the Greenville Cotton Mills, Greenville, N. C.

IMPORTATION OF DYESTUFFS INTO TIENTSIN DURING 1926

Imports of Indigo into Tietsin for 1926 to December 7, were 36,392 piculs against 45,528 piculs for the corresponding period in 1925, and 46,130 piculs for the whole year 1925. The decrease is probably due to the small sales in the spring season, necessitating smaller replacements. Small spring sales were due to the disorganization of transportation facilities due to civil wars. Lack of transportation not only prevented the shipment of dyestuffs to the sales points in the interior, but also prevents the shipping of yarn and piece goods, thereby paralyzing the dyeing industry.

It is estimated that about 19,000 piculs or about 53 per cent of the imports of indigo paste were of American origin. Probably the remaining 47 per cent could be divided into 42 per cent German and 5 per cent Swiss, French and English.

Competition has been increasingly severe during the year, the German factories having twice cut their contract price to their sales syndicates.

The rate for "Position Wanted" advertisements in this column is 2 cents a word—with a minimum of 50 cents per insertion. For all other types of advertisements—i. e., help wanted, machinery or supplies for sale—the rate is $5.00 per column inch or less per insertion.

COLOR CHEMIST

Color Chemist.—Experienced with all classes of dyestuffs and textiles. Standardizing, matching and research work. Wishes position in laboratory. Reply Box 374, American Dyestuff Reporter.

FOR SALE

A complete Dyeing and Finishing Plant located in the Central West, fully equipped with modern machinery; land and buildings suitable for expansion, equipped for the dyeing and finishing of upholstery, denims, dress goods, coatings, cloakings, etc. Reply Box 375, American Dyestuff Reporter.